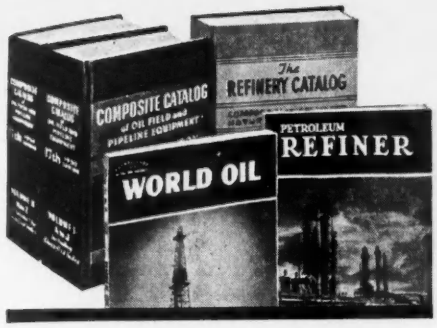

Specialized Oil Publications of
THE GULF PUBLISHING COMPANY
3301 Buffalo Drive, Houston 6, Texas
Box 2608, Houston 1, Texas

WORLD OIL and The COMPOSITE CATALOG
for the drilling-producing-pipe line industry

PETROLEUM REFINER and The REFINERY CATALOG
for the refining-natural gasoline industry

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Single copies 50 cents (except special issues). Subscription price: domestic and foreign, $2 a year; 2 years, $3; 3 years, $4. WORLD OIL, published every month except semi-monthly in February and July. Entered as *The Oil Weekly* as second class mail matter December 23, 1916, at the post office at Houston, Texas, under the act of March 3, 1879. Advertising rates on application. Copyright, 1950, by The Gulf Publishing Company.

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ABC

WORLD OIL

ABP

Established 1916 as THE OIL WEEKLY

September, 1950 **Vol. 131, No. 4**

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Looking Ahead

PERMIAN BASIN of West Texas and southeast New Mexico seems headed for eventual production of 1½ million barrels per day, equivalent to current output of Venezuela, second largest producing country. Permian Basin crude output went above 1 million barrels daily for first time in August and will average about 1,125,000 daily in September, still leaving reserve producing ability of 300,000 barrels per day, while more potential is being developed. (This special issue spotlights that remarkable district.)

U. S. WILL HAVE reserve oil producing ability of about 990,000 barrels daily while producing at September rates. Texas reserve of about 548,000 will include roughly 280,000 in West Texas, 215,000 in Gulf Coast-Southwest Texas, and small amounts in East and North Texas. California will have reserve of about 150,000, Louisiana 80,000, Oklahoma 80,000, Kansas 35,000, Wyoming 25,000, New Mexico 20,000, Colorado 13,000, Mississippi 12,000. (See Page 41.)

AS IN WORLD WAR II and postwar boom, transportation appears to be most vulnerable phase of industry's operations from standpoint of ability to supply oil requirements. In prospect now is possible shortage of tankers under U. S. flag for winter needs. Tanker market is expected to tighten up and tanker rates to increase worldwide. Although U. S. government and companies have about 50 tankers laid up, less than dozen are desirable for use. More pipe lines also are essential. especially out of Permian Basin, where September crude production will use up virtually all available pipe line capacity.

SEQUEL TO KERR BILL VETO: At Bartlesville, Oklahoma, September 11, Federal Power Commission will hold hearing aimed at fixing price that Phillips Petroleum Company receives for sales of its gas to interstate pipe line companies. Sequel to that, if it happens, as expected: same deal for small independent oil and gas producer and royalty owner. The unhappy ending, unless Congress forbids: utility status, with price and rate regulation, for oil industry as well as natural gas industry—a mile post on the road to state socialism.

TIGHT SUPPLY OF HEATING OIL for coming winter is threatened, due to indicated record consumption and possible scarcity of tankers. During first half of current summer stock buildup period, East Coast-Gulf Coast refiners accumulated in storage less than half as much heating oil as was withdrawn from stocks during last winter's heating season. Marketers consequently are worried and seeking more supplies from refiners, and recently bid price up one-half cent a gallon. This better price gives refiner incentive to make more heating oil, even at expense of lower recovery of gasoline, and should help to assure adequate supplies.

WAR DEMANDS not only will increase wildcatting but will result in more efficient operation of existing fields. With increased drilling every effort will be made to produce present fields under the most effective engineering methods. More attention is expected to go to secondary recovery, and water-flooding operations will be broadened. Another trend is noted toward unitized operation.

For the convenience of readers the Table of Contents which has occupied this page has been moved to a permanent position on Page 1. The Advertisers' Index is permanently located on Page 2.

DOWELL SPINNER SURVEY located thief formation accurately when lost circulation threatened drilling

When remedial work is necessary to restore lost circulation, a key question is the exact location of the one or more thief zones. An accurate source of this information is a Dowell Spinner Survey, one of the Electric Pilot services.

Spinner Surveys made by Dowell engineers have made it possible to pinpoint the zones where the loss is occurring. With this information the remedial work can be accomplished more quickly and economically, and with the best possible chance of success. For example: After drilling to 8900 feet, loss of returns occurred when the mud weight was increased. No satisfactory material could be found to restore circulation, so a Dowell Spinner Survey was made. This showed the mud loss was occurring between 2195 and 2300 feet. This zone was squeezed off and drilling continued with full circulation.

Location of thief zones is only one of the proved uses of the Spinner Survey. Ask your Dowell engineer about using a Spinner Survey to determine the relative permeability of exposed zones in a producing or injection well, the relative production of zones in a producing oil or gas well, the location of holes in pipe and leaks in casing seats and bottom hole plugs.

DOWELL INCORPORATED
TULSA 3, OKLAHOMA
Subsidiary of The Dow Chemical Company

DOWELL
SPINNER SURVEY

Ask your nearest Dowell station for complete information on these Dowell services and products: Acidizing, Electric Pilot Services, Plastic Service, Chemical Scale Removal Service for heat exchange equipment, Jelflake, Paraffin Solvents, Magnesium Anodes for corrosion control, and Bulk Inhibited Hydrochloric Acid.

"Petroleum Promotes Progress"

Look to **DOWELL**

FOR OIL INDUSTRY CHEMICAL SERVICE

Editor's Page

OIL SUPPLY DEPENDS ON STEEL

ENOUGH STEEL to maintain drilling rates near present peak levels must be provided the petroleum industry if the U. S. is to have adequate oil producing ability to fulfill the prospective enormous needs of a large-scale all-out war. Additional steel also will be needed to expand refining and pipe line facilities sufficiently to process and transport wartime requirements.

Two World Wars have demonstrated how necessary an ample supply of oil for both military and essential industrial-civilian needs is in times of national defense. Despite civilian rationing, it was necessary to increase the 1941 daily average U. S. crude production by 1 million barrels per day, or 27 percent, before the end of World War II. Since authorities have warned that military use of petroleum will be much greater than in World War II, when it attained a peak of 1,377,000 barrels per day, it would seem desirable to have a surplus producing capacity of not less than 1½ million barrels daily.

Peak drilling rates substantially boosted U. S. oil producing ability after termination of World War II, but recently enlarged output already has used up much of the surplus supply. Although the Korean war has not yet had time to have much effect on oil demand and certainly must be recognized as a comparatively small-scale military operation, September production will be nearly 1 million barrels per day greater than in March. Some additional reserve producing ability still exists, but it could be used up in a short period of all-out warfare, involving unprecedented military requirements and much greater essential industrial-civilian consumption than in the last war, as industry, homes and agriculture have installed more oil-using equipment.

Ability of the industry to produce enough oil to meet growing requirements is dependent upon a continued aggressive drilling program. With the sharp gains in U. S. oil needs of the past year certain to be extended further as this country re-arms, the essential nature of an adequate drilling program is obvious. To insure a producing ability sufficient to answer whatever needs may develop from the present international situation, drilling operations must be continued at a high level. Additional wells must be completed not only to supply increased requirements of oil but also to offset the natural decline in productivity of older wells. The Independent Petroleum Association of America recently estimated U. S. ability to produce would decline nearly 500,000 barrels per day within one year if drilling were stopped, which means that about half of the new wells drilled are required merely to offset the normal decrease in producing capacity of older properties. Thus, even to maintain present producing ability would require about 20,000 wells per year. this would not suffice to fuel a full-scale war.

Recent record drilling activity already has created a shortage of tubular goods despite high production rates by steel mills, so neither the steel industry nor the oil industry has a back-log supply. While tubular goods are the largest single item of equipment needed for drilling operations, other machinery and specialized tools and equipment also are required for producing wells. To maintain drilling activity at present rates of 40,000 wells and 140 million feet of hole annually would require approximately 1½ million tons of tubular goods, with an additional 1¼ million tons yearly to equip and maintain producing wells.

The industry also will need steel for pipe line and refining operations. Present transportation facilities are not adequate to handle the large amounts needed in time of full-scale war. Likewise, present refining capacity of a little more than 6.7 million barrels per day will be inadequate.

As this country steps up the production of military armament, a return to government allocation of steel seems certain. Therefore, it is well that both the National Petroleum Council and the Independent Petroleum Association of America have appointed committees to study the industry's steel requirements. These studies can serve to properly inform appropriate authorities and claim agencies, when such are designated, as to the steel needed to provide a large enough supply of petroleum.

Warren L. Baker

No wonder it is called "the most VERSATILE* tool in the oil business"

**Webster's Dictionary defines as, "Turning with ease from one thing to another; having an aptitude for new tasks."*

Although we know of literally dozens of different types of jobs that have been performed with the Baker Model "K" Cement Retainer and Casing Bridge Plug (Product No. 400) there are probably an equal, or greater number of "new tasks" which have not come to our knowledge.

It is easy to generalize and list the uses of this truly remarkable device for placing and squeezing cement; placing and squeezing plastics; acidizing; testing; as a bridge plug; and as a fishing tool. But think of the endless variations of these applications, and you will understand why a Baker sales and service engineer had the following to say in an address made to his fellow field workers:

"Certainly I'm enthusiastic about the Baker Cement Retainer—in fact I am *excited* about it! Has any other tool in the oil business successfully solved so many problems? Has any other tool accomplished more? I think not.

"I have seen liners screwed on the bottom of this Retainer, run in the well and cemented. I have seen it set in liners, and the liner run in the well and cemented. I have seen it set between perforations, and cement circulated behind the casing; and I have seen it set in parted strings of casing, the casing picked up, and cemented back in place.

"It has been routine to place plastic in a well with the Baker Model "K" Cement Retainer for the purpose of reducing high gas/oil ratios. Its use has been routine for the purpose of consolidating sands, and plastic has been pumped through it for repairing breaks in casing. But there are many other variations. Not only has a one-zone acid job been done with this tool, it has been used for acidizing two zones. Not only have these zones been acidized, but the well has been brought in through the tool, and a test made. Not only has a test been made through the tool after acidizing, it has been left in the well and used as a production packer! I have helped in its being set above perforations, the well brought in by swabbing or circulating water, a test made; and when the water/oil, or gas/oil ratio was too high, a squeeze job performed through the retainer.

"Has its use been confined to the setting in casing? Not at all; it has been successfully used in open hole.

"In addition to these few applications mentioned, the Baker Model "K" Cement Retainer can be used as a bridge plug! Has any other tool in the oil business successfully solved so many problems? Is any other tool so versatile? I think not. What is its future? What will be the future problems encountered in drilling and producing oil wells; what will be the future problems of secondary recovery; what will be the future problems in remedial work? What new media will be used for cementing, plugging, consolidating and acidizing? I am certain that the solutions to these problems will involve the use of the Baker Model "K" Cement Retainer and Casing Bridge Plug, and improvements and adaptations of it."

ABOVE
Construction details of "Cement Retainer" equipped with Junk Pusher.

LEFT
Baker Cement Retainer, with Circulation Joint and Control Unit, to provide "versatility".

RIGHT
Baker Retainer "Bridge Plug" with Wire Line Pressure Setting Assembly.

The Baker Junk Pusher has slots which permit passage of displaced fluid, but prevent passage of junk or debris which might foul the slips.

NOW RUN AND SET ON AN ELECTRICAL CONDUCTOR CABLE

Since the above address was delivered, and as if to justify this man's predictions of the future, we have developed a method for setting this efficient device as a Casing Bridge Plug when run on an electrical conductor cable. This application is available through several leading service organizations having trucks equipped with all necessary accessory equipment to set the Baker Model "K" Retainer Bridge Plug, Product No. 400-D, accurately at the desired depth, to provide a positive, leak-proof bridge plug which prevents movement of fluid or gas either up or down the well. The "Cast Iron" type Bridge Plug is recommended for permanent installations; the "Magnesium Alloy" type for use as a temporary bridge plug. The former type is designed with easy drillability in mind (even to segmented slips which break up readily); while the "Magnesium" Bridge Plug represents the ultimate in easy drillability.

Complete descriptions, illustrations and specifications are in the Composite Catalog, as well as the separate Baker Catalog gladly sent to any oil man upon request. Inquiries to any Baker Office or representative will receive prompt and courteous attention.

BAKER
OIL TOOLS, INC.
HOUSTON • LOS ANGELES
NEW YORK

The Changing Panorama

U. S. Production to be 86.5 Percent of Capacity

U. S. production of all oils will average approximately 6,332,000 barrels per day, or 86.5 percent of indicated capacity to produce oil without damage to reservoirs, during September, 1950. This is indicated by allowables scheduled for the month and by a survey of current producing ability of the different states.

Based on data as of July 31, the U. S. has the ability to produce approximately 7,321,677 barrels per day of all oils, including crude oil, lease condensate, and natural gasoline and allied products. Of this total producing ability, there will be in reserve or unused during September approximately 990,000 barrels per day, or 13.5 percent.

Although the refining division of the industry during peace time has satisfactorily operated at around 86.5 percent of capacity, this rate for the production division is on the high side even for ordinary times and it is dangerously crowding potential under present conditions, since chance and luck greatly affect efforts to find new reserves and maintain or increase producing ability. While refining capacity can be maintained through repairs and increased at will, producing ability maintenance or expansion requires not only constant and substantial drilling but also luck in finding new reserves. A reserve of 13.5 percent of producing ability could soon be used up by increasing demand, and the time would be shortened with producing ability itself declining for lack of adequate discoveries.

Total U. S. oil producing ability of 7,321,677 barrels per day was indicated as of July 31, 1950, by reports of state conservation authorities to the Interstate Oil Compact Commission, supplemented here by several WORLD OIL estimates, based on information from private sources. This total included 6,763,377 barrels per day of crude oil, 73,300 of lease condensate handled in pipe lines along with crude and treated as crude in Bureau of Mines statistics, and 485,000 barrels per day of natural gasoline and allied products. Details by states and districts are shown in a table herewith.

As of July 31, actual production of all oils averaged approximately 5,981,750 barrels per day, or 81.7 percent of capacity, and reserve producing ability of 1,339,927 barrels per day was 18.3 percent of the potential. But production was materially increased in August and will be still higher in September, due especially to increased allowables in Texas; and as a result, as previously stated, September output of about 6,332,000 barrels daily will be at 86.5 percent of capacity, leaving in reserve only 989,677 barrels daily or 13.5 percent of potential. Thus within two months, 350,250 barrels per day or more than one-fourth of the July 31 reserve of 1,339,927 barrels has been used up.

September production will set another new all-time record, following August output slightly above the previous record made in

■ CONTINUED ON PAGE 50

U. S. Oil Producing Ability 1.3 Million Barrels Per Day Above Actual Production as of July 31, 1950; Only 989,677 Above Output in September

(Producing ability based on Interstate Oil Compact Commission survey, except as noted.)

Barrels Per Day, as of July 31, 1950, Except as Noted

State or District	Actual Prod.	Reserve Producing Ability	Total Producing Ability
CRUDE OIL			
Alabama	1,900	500	2,400
Arkansas	81,400	?	81,400
California	891,200	*150,000	1,041,200
Colorado	60,000	13,560	73,560
Florida	1,550	?	1,550
Illinois	179,250	?	179,250
Indiana	31,150	?	31,150
Kansas	301,550	36,608	338,158
Kentucky	28,900	?	28,900
Louisiana	561,850	100,000	661,850
Michigan	43,400	?	43,400
Mississippi	108,900	12,176	121,076
Missouri	100	.....	100
Montana	23,900	440	24,340
Nebraska	2,450	?	2,450
New Mexico	131,050	20,000	151,050
New York	12,000	?	12,000
Ohio	9,200	?	9,200
Oklahoma	445,250	80,675	525,925
Pennsylvania	34,000	6,000	40,000
Tennessee	100	.....	100
Texas	2,329,900	†869,968	†3,199,868
District:			
1 S. Central	29,450	5,419	34,869
2 Middle Gulf	138,850	62,548	201,398
3 Upper Gulf	390,150	188,418	578,568
4 Lwr. Gulf-S.W.	218,000	79,333	297,333
5 East Central	36,200	23,087	59,287
6 Northeast	93,600	42,083	135,683
6 East Texas Fld	275,400	23,179	298,579
7-B N. Central	72,100	17,898	89,998
7-C West	57,750	20,488	78,238
8 West	772,800	442,781	1,215,581
9 North	153,100	35,187	188,287
10 Panhandle	92,500	85	92,585
Less est. underprod	.....	—70,538	—70,538
Utah	3,250	?	3,250
Virginia	100	.....	100
West Virginia	7,800	?	7,800
Wyoming	158,300	*25,000	183,300
Total, Crude Oil	5,448,450	1,314,927	6,763,377

State or District	Actual Prod.	Reserve Producing Ability	Total Producing Ability
LEASE CONDENSATE			
Arkansas	4,250	.....	4,250
California	2,550	.....	2,550
Louisiana	24,550	.....	24,550
Mississippi	3,750	.....	3,750
Texas	37,700	.....	37,700
Wyoming	500	.....	500
Total, Lse Cond.	73,300	.....	73,300
Total, Crude & Lse. Cond	5,521,750	1,314,927	6,836,677
NATURAL GASOLINE & ALLIED PRODS.			
United States, Total	460,000	*25,000	485,000
ALL OILS			
United States, Total	5,981,750	1,339,927	7,321,677
EST. U.S. PROD. IN AUG. & SEPT.			
August:			
Crude Oil	5,603,600	1,159,777	6,763,377
Lease Condensate	71,350	1,950	73,300
Total, Crude-Cond	5,674,950	1,161,727	6,836,677
Natural Gasoline, etc	460,000	25,000	485,000
Total, All Oils	6,134,950	1,186,727	7,321,677
September:			
Crude Oil	5,800,000	963,377	6,763,377
Lease Condensate	72,000	1,300	73,300
Total, Crude-Cond	5,872,000	964,677	6,836,677
Natural Gasoline, etc	460,000	25,000	485,000
Total, All Oils	6,332,000	989,677	7,321,677

* Estimate from private sources.

† Theoretically, Texas on August 1, 1950, had reserve producing ability of 940,506 barrels daily above actual production of 2,329,900, indicating total producing ability of 3,270,406; but under proration, wells cannot make up production lost through shutdowns for workover or repairs and such lost production averages about 7½ percent.

Report from the Observatory

Peak Operations Lie Ahead

By **RAY L. DUDLEY**, Publisher, and **WARREN L. BAKER**, Editor

PEAK LEVEL OPERATIONS are proving necessary for the industry to meet current sharply expanded industrial-civilian and military demands for petroleum, and a need for even larger volumes is indicated to supply satisfactorily the greater consuming rates which seem assured for the fourth quarter of 1950 and the first quarter of 1951. It is significant that near-record production and refining volumes in recent months have failed to enlarge stocks of either crude or refined products, hence the industry's inventories remain at low levels. These conditions presage that the industry may face supply problems in the future, since additional gains in consumption appear certain and of enormous size should international affairs develop into a full-scale war.

• • •

U. S. PRODUCTION of crude and condensate will reach an all-time high in September of approximately 5,875,000 barrels daily. While this will constitute an impressive gain, being a million barrels per day greater than last March and about 185,000 barrels a day above the previous peak reached in December, 1948, it will not be an excessive producing rate.

Although production in recent months has been near peak levels, stocks of crude oil have continued to decline. Whereas there were 244½ million barrels of crude oil in storage at the end of April, there were only 238½ million barrels in August. There is a possibility that the 200,000-barrel per day gain in September over August producing rates may cause small additions to crude inventories, but this would be desirable in view of their current low level and prospective high demand levels.

RECORD-BREAKING REFINERY operations, which in August exceeded 6 million barrels to be 750,000 barrels per day higher than in April, have brought peak output to refined products. Nevertheless, demand has been so large that stocks of petroleum products remain definitely low and, like crude storage, need to be enlarged.

Distillate fuel oil represents the most serious supply problem. A shortage of heating oil is possible next winter, as distillate fuel oil inventories on August 19 were 10 million barrels under year-ago levels in totaling only 65 million barrels. Although this represents an increase of 27½ million barrels since the end of March, present stocks do not appear sufficient to meet the substantially enlarged heating needs indicated for next winter by the installation of a large number of new burners. The situation could become serious if the winter proves severe, although encouragement is offered by the larger than normal summer buying evidently created by consumers anticipating both a wartime shortage and higher prices.

Meanwhile, residual fuel stocks are 26 million below 1949 levels. However, they are not viewed with alarm because demand is expected to show only a comparatively small gain unless full-scale war boosts naval and shipping operations.

Gasoline stocks on August 19 were at practically the same level as a year previous, although they had been 6 million barrels greater than 1949 levels at the beginning of the consuming season the end of March. The surprising thing in connection with gasoline has been consuming rates, which have been large enough to consume the peak quantities turned out by refineries. Further enlargement of motor fuel production in September could stop reductions in gasoline stocks, so there is a need for refiners to increase their yield of distillate fuel oils.

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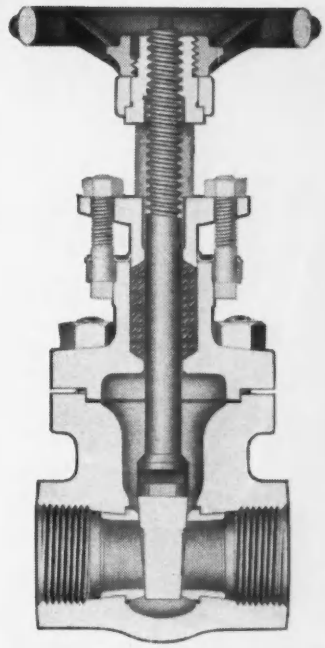

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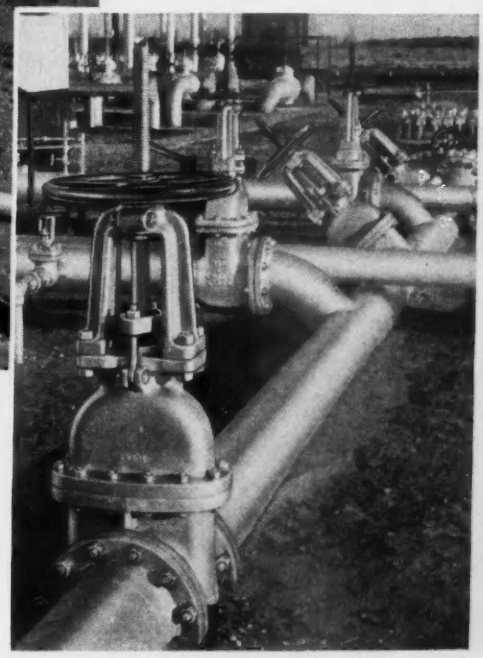

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CRANE

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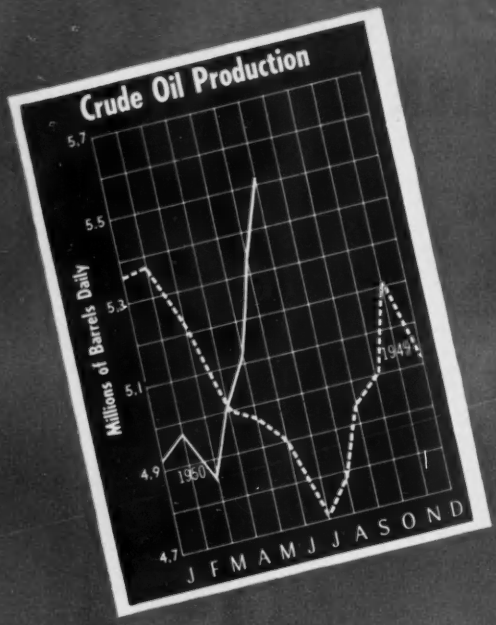
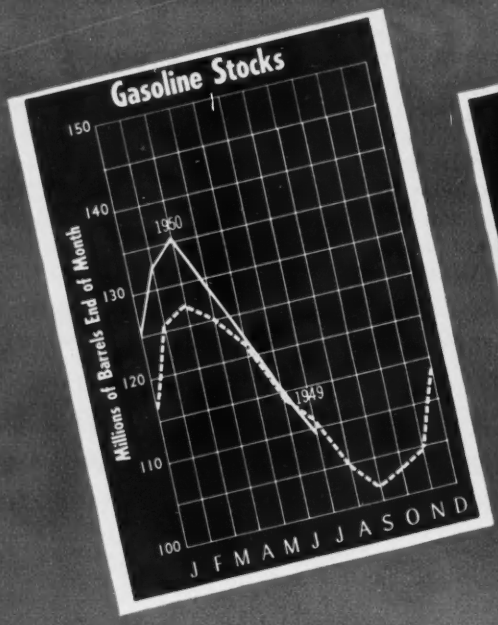
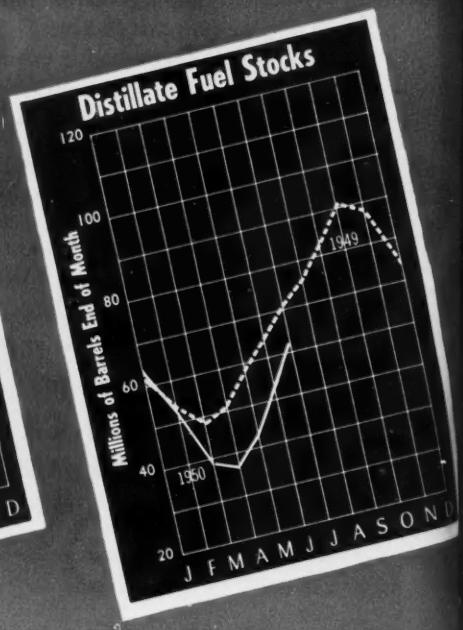
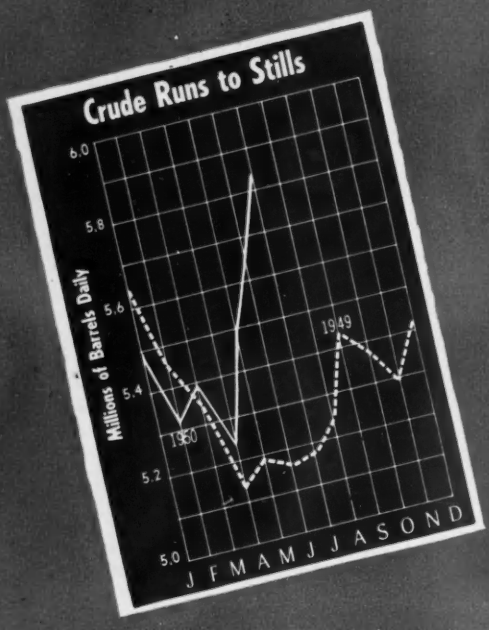
Petroleum

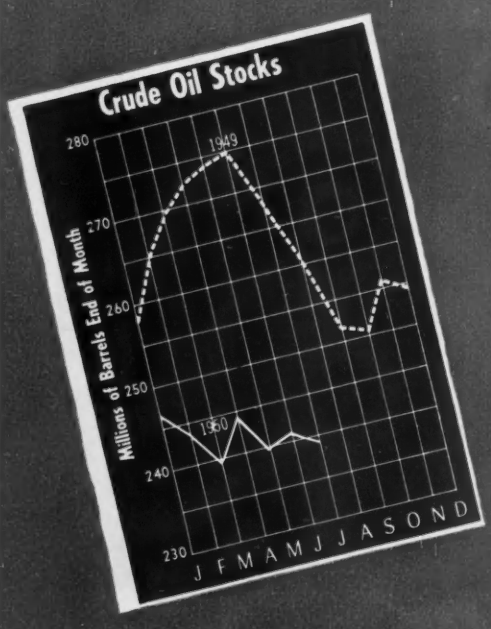
By CECIL W. SMITH
Statistical Editor







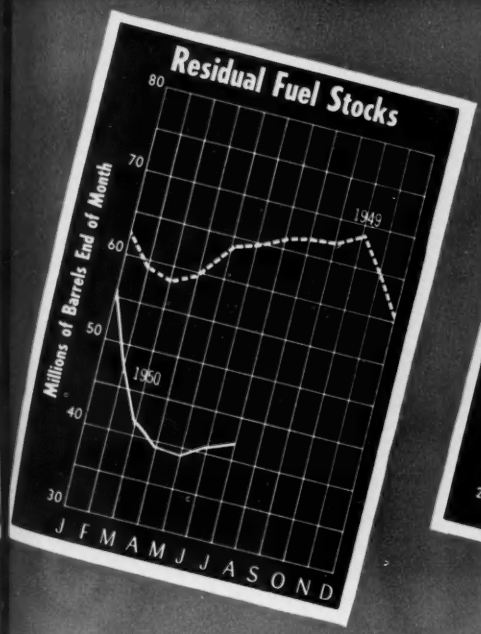


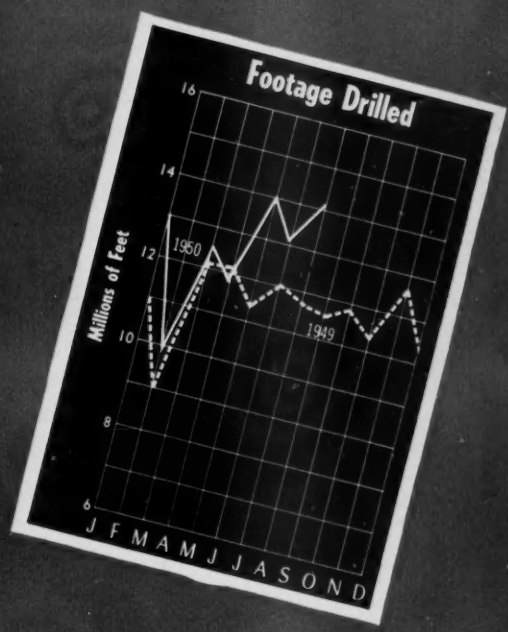


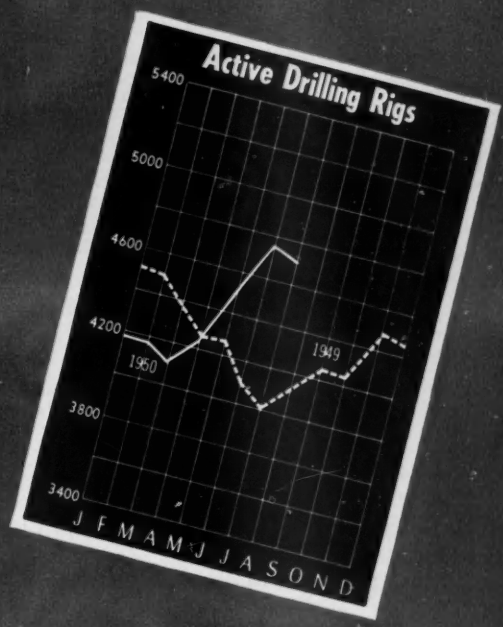
State Crude Oil Production
(THOUSANDS OF BARRELS)

STATE or DISTRICT	DAILY AVERAGE PRODUCTION July, 1950	June, 1950	July, 1949	% Diff. July, 49-50	TOTAL FIRST 7 MONTHS 1950	1949	% Diff. 49-50
Alabama	1.8	1.8	1.2	+ 50.0	347	253	+ 37.2
Arkansas	84.7	83.4	73.3	+ 15.6	18,078	17,564	+ 2.9
California	888.6	869.0	906.9	— 2.0	184,035	197,861	— 7.0
Colorado	59.8	59.7	.....	.....	12,788	13,975	— 8.5
Florida	1.5	1.5	.....	.....	242	276	— 12.3
Illinois	176.5	173.2	174.6	+ 1.1	36,407	37,021	— 1.7
Indiana	30.9	30.2	25.9	+ 19.3	5,860	5,207	+ 12.5
Kansas	298.2	277.4	250.5	+ 19.0	60,298	59,894	+ 0.7
Kentucky	28.6	26.0	22.8	+ 25.4	5,557	4,825	+ 15.2
Louisiana	588.5	587.9	497.2	+ 18.4	117,954	109,709	+ 7.5
North Louisiana	128.6	131.7	117.6	+ 9.4	26,583	25,837	+ 2.9
South Louisiana	459.9	456.2	379.6	+ 21.2	91,371	83,872	+ 8.9
Michigan	45.1	42.0	43.0	+ 4.9	9,412	9,418	— 0.1
Mississippi	113.1	109.3	99.1	+ 14.1	21,817	22,716	— 4.0
Missouri	0.1	0.1	.....	.....	18	27	— 33.3
Montana	23.4	21.6	25.6	— 8.6	4,637	5,478	— 15.4
Nebraska	2.4	2.0	0.9	+166.7	464	142	+226.8
New Mexico	131.0	125.3	126.9	+ 3.2	27,196	28,081	— 3.2
New York	43.8	14.2	11.3	+ 22.1	2,578	2,500	+ 3.1
Ohio	9.4	9.2	8.9	+ 5.6	1,947	1,986	— 2.0
Oklahoma	441.7	423.5	389.5	+ 13.4	88,387	88,197	+ 0.2
Pennsylvania	30.9	30.8	29.6	+ 4.4	6,602	6,732	— 1.9
Tennessee	0.1	0.1	.....	.....	14	5	+180.0
Texas	2,374.4	2,290.0	1,806.7	+ 31.4	442,507	436,599	+ 1.4
Dist. 1—South Central	29.5	28.5	25.7	+ 14.8	5,754	5,595	+ 2.8
Dist. 2—Middle Gulf	141.4	135.5	112.0	+ 26.3	26,241	28,565	— 8.1
Dist. 3—Upper Gulf	412.5	420.3	351.1	+ 17.5	81,318	85,554	— 5.0
Dist. 4—L. Gulf-S.W.	221.1	213.4	178.3	+ 24.0	41,499	42,442	— 2.2
Dist. 5—East Central	36.7	34.4	32.5	+ 12.9	6,718	8,220	— 18.3
Dist. 6—Northeast	373.4	373.5	305.7	+ 22.1	72,136	76,454	— 5.6
Dist. 7-B N. Central	72.2	69.8	57.5	+ 25.6	13,915	12,767	+ 9.0
Dist. 7-C—West Central	65.8	62.6	41.5	+ 58.6	11,716	9,505	+ 23.3
Dist. 8—West	776.1	716 1	501.4	+ 54.8	134,150	122,200	+ 9.8
Dist. 9—North	153.2	143.7	137.2	+ 11.7	29,385	27,933	+ 5.2
Dist. 10—Panhandle	92.5	92.2	93.8	— 1.4	19,278	19,070	+ 1.1
Utah	3.2	3.2	.....	.....	669	102	+555.9
Virginia	0.1	0.1	.....	.....	16	24	— 33.3
West Virginia	7.7	8.0	7.6	+ 1.3	1,662	1,589	+ 4.6
Wyoming	158.2	153.6	129.0	+ 22.6	33,096	26,781	+ 23.6
Total, United States	5,513.7	5,344.1	4,703.8	+ 17.2	1,082,588	1,076,962	+ 0.5

Trends in the U.S.







Crude Oil and Refined Products Trends

(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month
1948:									
May	5,502	5,668	231,318	2,486	108,552	992	38,551	1,314	41,123
June	5,544	5,632	231,412	2,529	104,518	998	45,835	1,280	44,213
July	5,522	5,631	230,955	2,494	98,839	994	56,045	1,264	49,448
August	5,577	5,621	231,954	2,532	95,445	1,038	65,887	1,248	55,009
September	5,435	5,376	237,302	2,416	90,518	961	73,854	1,154	58,682
October	5,632	5,594	243,972	2,490	92,426	1,069	79,992	1,268	61,456
November	5,675	5,672	250,066	2,551	95,589	1,081	80,658	1,277	64,865
December	5,688	5,720	256,254	2,626	103,697	1,106	71,475	1,299	64,021
1949:									
January	5,365	5,641	258,648	2,538	116,621	1,063	61,584	1,348	62,508
February	5,376	5,480	265,216	2,484	126,054	1,004	53,937	1,282	59,398
March	5,224	5,352	269,341	2,470	127,443	993	48,923	1,258	58,190
April	5,012	5,141	272,520	2,494	125,351	846	51,231	1,147	59,668
May	4,972	5,195	273,912	2,585	121,602	813	57,442	1,138	63,576
June	4,903	5,162	274,691	2,597	114,041	771	64,730	1,041	64,628
July	4,704	5,173	267,586	2,613	111,217	835	71,553	1,040	66,084
August	4,780	5,241	260,585	2,593	104,879	902	76,037	1,078	66,843
September	4,940	5,427	251,689	2,617	101,799	1,002	83,213	1,110	67,117
October	5,997	5,373	250,932	2,643	103,287	1,001	90,643	1,141	68,673
November	5,210	5,293	256,010	2,594	104,707	962	88,212	1,180	65,112
December	5,024	5,475	253,356	2,633	111,521	1,032	75,207	1,203	60,193
1950:									
January	4,922	5,483	246,610	2,575	125,298	1,048	63,932	1,209	55,808
February	4,967	5,316	243,750	2,552	132,796	1,026	52,206	1,172	47,828
March	4,878	5,336	241,098	2,539	133,766	938	37,777	1,154	41,860
April	4,968	5,193	244,605	2,508	128,057	977	37,530	1,048	39,979
May	5,143	5,535	239,877	2,647	121,035	997	42,739	1,063	39,482
June	5,343	5,642	240,943	2,752	114,267	1,016	52,941	1,073	40,649
July	5,514	5,844	239,829	2,824	109,117	1,038	61,665	1,139	42,121
July, 1950 Change:									
In Month	+171	+202	— 1,114	+ 72	—5,150	+ 22	+8,724	+66	+ 1,472
In Year	+810	+671	—27,757	+211	—2,100	+203	—9,888	+99	—23,963
Week Ended:									
Aug. 12, 1950	5,675	6,044	238,554	2,901	108,518	1,098	63,053	1,112	41,810
Aug. 13, 1949	4,775	5,227	268,730	2,626	108,174	818	73,815	1,040	67,818

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Monthly News Analysis

Imports Clamor Stilled

Having emphasized the desirability of ample petroleum supplies for possible emergency requirements, the Korean war has stilled clamor for restriction of imports, invited increases in stocks, and indicated advisability of all possible expansion of domestic producing ability.

There is no immediate need of action to restrict imports, reported the National Petroleum Council's Petroleum Imports Committee in late July. The group merely recommended that "the relationship between imports and domestic demand be again considered if the present trend changes."

The committee said that "fair and equitable relationships" should prevail between total demand and total import volumes and that "imports of crude oil and its products if increased beyond the limits of supplementing domestic production will adversely affect the domestic industry, the national economy and national security." Over the short term, it was observed, the change in the international situation may make advisable a rapid rebuilding of inventories and a renewed effort to develop greater domestic excess producing capacity.

Specifically, as a means of computing a balance between demand and imports, the NPC committee suggested:

"Data on import expectancy and actual imports should be made available as promptly as those covering domestic crude oil production and refinery operations. To this end it would be helpful if:

"1. The Secretary of the Interior, through the Bureau of Mines, obtained monthly from each importing company its estimates of the amount of crude oil and each petroleum product which it expects to import during each succeeding three months period and the total of such estimates as to crude oil and each of the products separately were published monthly in the Monthly Petroleum Forecast of the Bureau of Mines.

"2. The Bureau of Mines used the above information on imports when preparing its Forecast of Crude Oil Demand by States.

"3. There be gathered by some agency of the petroleum industry and made public weekly import statistics covering crude oil, and each of its products. Such data should be issued each week for the previous week, showing also the daily averages for the preceding four weeks."

NPC Advisors Appointed

As in World Wars I and II, the U. S. will have advice and cooperation on oil problems from well qualified men of the industry during the present emergency. Toward this end, Walter S. Hallanan, chairman of the National Petroleum Council, has appointed 4 new committees to deal with problems affecting the industry and the nation under present conditions.

1. The Petroleum Industry Transportation Committee, headed by P. C. Spencer, president of Sinclair Oil Corporation, New York, will make a study of all petroleum transportation facilities--tankers, barges, tank cars, trucks, and pipe lines—and report on adequacy of those facilities.

2. The Military and Government Petroleum Requirements Committee, set up at request of Secretary of Interior Chapman, is headed by B. B. Jennings, Socony-Vacuum Oil Company, New York, as chairman, and J. Frank Drake, Gulf Oil Corporation, Pittsburgh, as vice chairman.

3. The Committee on Storage Capacity is headed by L. S. Wescoat, The Pure Oil Company, Chicago.

4. The Committee on Petroleum Industry Steel Requirements, which is dealing with a vital phase of industry operations, is headed by Russell B. Brown, general counsel of Independent Petroleum Association of America, Washington.

INSERT MAP OF PERMIAN BASIN

Accompanying this issue of WORLD OIL is a large-scale unusual multi-colored insert map of the Permian Basin area of West Texas and southeast New Mexico. Unlike the ordinary map, in which oil fields are shown in one color and gas fields in another, different colors are used to designate the geologic age of producing formations in each field. This makes it easy to tell at a glance whether a field produces from the Permian, Mississippian, Ordovician, etc., or from several of these formations.

Renegotiation Feared

Thousands of oil and gas producers would have their contracts subject to renegotiation for several years henceforth if a House bill is enacted without the exemption provisions contained in the present law. House Resolution 9246 would leave producers uncertain as to the price received for crude oil sold to refiners making military products. Each producer would be obliged to set aside a special reserve fund in case the government renegotiated his crude price on the basis of the producer's costs and demanded refund of part of the selling price.

Robert G. Dunlop, president of Sun Oil Company, told the House Ways and Means Committee in hearings on the bill that the renegotiation provision threatens to be a real obstacle to maximum output of war-needed petroleum products. Dunlop argued that oil and gas are a vanishing capital asset; if the crude producer "sells a quantity of oil during a period when he is subject to renegotiation, he would have that much less to sell when renegotiation has been terminated. Thus the effect of inclusion of crude oil within the area subject to renegotiation puts a premium on non-cooperation with the war effort and penalizes the crude producer who does cooperate."

The renegotiation threat would paralyze continuing exploratory work for new oil, Dunlop said, and adversely affect hundreds of thousands of royalty holders as well.

C. H. Murphy, Jr., of El Dorado, Ark., a natural gas producer, told the committee that the proposed change in law "would have a disruptive effect on the producing branch of the petroleum industry,

hampering development and exploratory activities and tending to endanger the adequacy of oil and gas supplies for our national needs."

He said costs in the case of crude oil and natural gas must be considered on the basis of replacement. "Replacement cost is the cost of finding and developing new reserves to replace the oil currently being produced. The oil producer must operate on the basis of replacement cost if he is to continue in business and not find himself in a process of liquidation. To illustrate; my own group is selling oil developed in the low-cost 1930's which must be replaced by oil explored for and developed in the high-cost 1950's."

Wesley E. Disney, general counsel for the Independent Natural Gas Association of America, testified that since gas already is under regulation by state and federal authorities, it should not be included in renegotiation legislation.

Industry Must Be Free

A feature of the National Association of Manufacturers' broadcast over the ABC radio network recently was a report by various industrial leaders on industry's capacity and readiness to meet both military and civilian needs in a national crisis such as now confronts the U. S.

Speaking for the petroleum industry was Dr. Robert E. Wilson, chairman of the board, Standard Oil Company (Indiana). Here is a digest of his remarks:

"Since the end of the last war the petroleum industry has increased its capacity to produce, refine and transport petroleum products by more than 25 percent. It has spent over $8 billion on additional facilities. Much of that expenditure came from plowing back a large proportion of its postwar profits. For the immediate future oil companies can supply all military requirements and meet all civilian needs on the usual scale.

"No industry made a better record in World War II than did ours in supplying both military needs and essential civilian requirements. The reason was that thousands of individuals, privately managed companies were competing vigorously in service to the nation with a minimum of government control. Competition should continue, so far as possible, without governmental controls, if the strength of our industry is to be fully utilized."

Federal-State Dispute Slows Continental Shelf Development

By HENRY OZANNE, Eastern District Editor

LEGAL uncertainties caused by the federal-state controvery over continental shelf leases are slowing offshore oil and gas development and even threaten to halt all new exploratory work. This was the recent testimony of industry and state spokesmen to congressional leaders in Washington in an attempt to achieve legislation that would permit development of the submerged lands until Congress passes legislation for the purpose.

After days of hearings before the Senate Interior and Insular Affairs Committee, the whole crucial question appeared hopelessly deadlocked. There was little possibility of an acceptable bill until far into 1951, and that delay, many industry authorities feel, may strike a disastrous blow at the whole tidelands program.

Walter S. Hallanan, president of Plymouth Oil Company and chairman of the National Petroleum Council, sketched the gloomy picture in detail to Senator O'Mahoney's committee in hearings on Senate Resolution 195 providing an interim basis for offshore operations. The bill as introduced is wholly unsatisfactory to industry and would fail in its aim of encouraging continuing tidelands work.

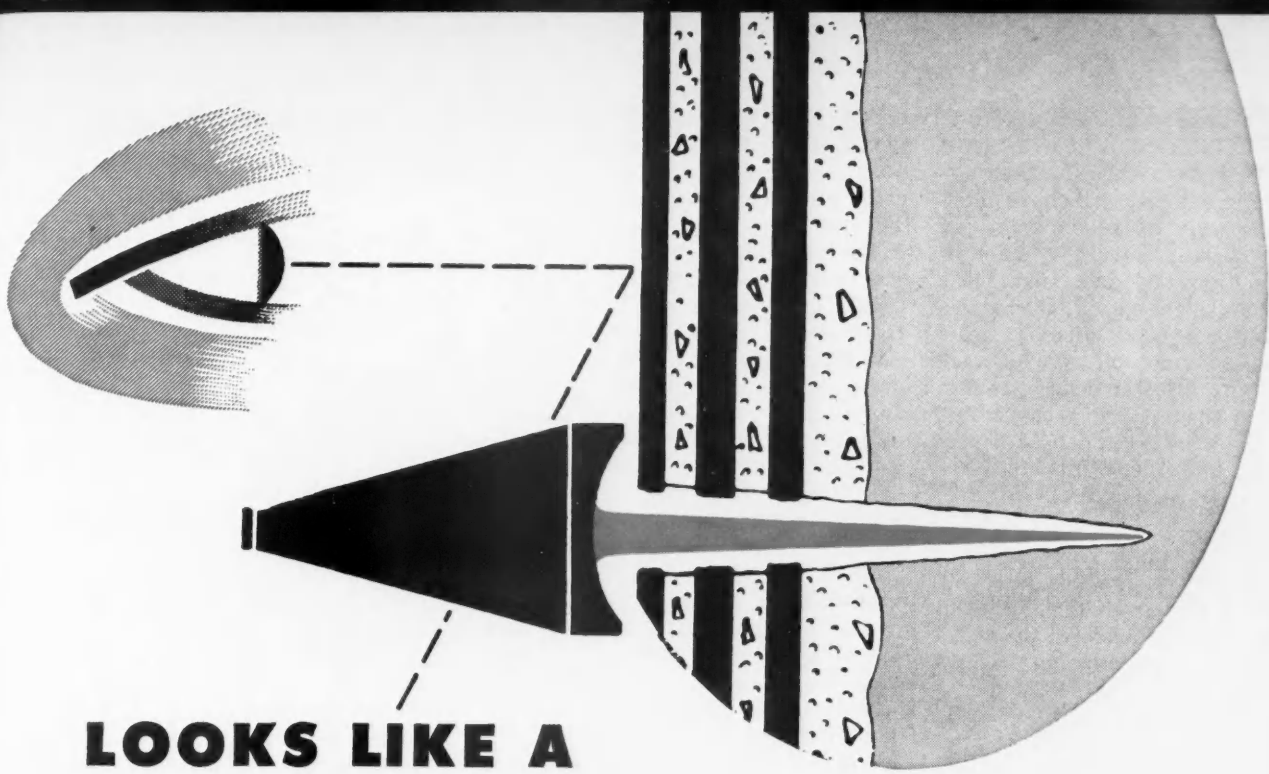
Senate Resolution 195 authorizes continued tidelands operation under terms of present state leases with rentals and royalties being paid to the Secretary of the Interior for deposit in a special fund pending disposition by Congress. Also, for 3 years the secretary could lease competitively for 5 years any submerged area below low tide not covered by a state lease. However, in this form the bill lacks the necessary protection to the companies to induce them to continue operations. Industry witnesses asked several amendments, including:

- Guarantee that leases on which no drilling or producing operations are being conducted shall continue in full force and effect by payment of annual delay rentals as provided for in leases during the period in which the companies search for oil and gas.
- Guarantee that operators can continue operations as long as their wells produce oil or gas.
- Guarantee that renewals, extensions or replacements of a lease shall be treated the same as a lease issued prior to the bill's "cutoff" date of December 21, 1948.
- Guarantee that the operators be not obliged to pay royalties twice—once to the federal government and once to the state—to be certain that such payments are being made to the proper lessor before congressional determination of that issue.

Clayton L. Orn, attorney for The Ohio Oil Company, told the senators that his own company and its associates had already spent $1.4 million for Gulf of Mexico leases and about the same amount on geophysical exploration in search for oil plus another $5.5 million in drilling 3 dry holes and a small gas well. Orn pointed out that this investment of $8.3 million to date has not resulted in the discovery or production of a single barrel of oil. He added: "It is obvious that in the light of the Supreme Court opinion in the Texas and Louisiana cases, that the operators cannot continue spending vast sums of money in the hazardous search for oil under the open sea unless they are given definite assurance that if they do discover oil they will be permitted to produce their wells as long as they can produce."

Orn argued: "The resolution should contain a provision which will, in effect, authorize operators to continue operations as long as their wells will produce oil or gas. That would mean with all leases except those issued by California (where all leases are being maintained by drilling or production programs) that once an operator drilled a producing well he could produce that well as long as it could produce. Otherwise the operators cannot prudently invest their capital in a venture as hazardous as wildcatting in the open sea."

Hallanan said that offshore operators already had invested $234 million in the search for oil in the Gulf of Mexico, but their gross revenues from oil produced so far amounts to only $6.3 million. He said the $234 million expenditures comprised $48 million for geophysical work; $60 million for lease bonuses and lease rentals; and $126 million for marine



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equipment, platforms and drilling. Since 1938, he said, 190 wells have been drilled in the Gulf. Seventy-seven were wildcats which resulted in the discovery of 14 oil fields, all off the Louisiana coast. There are 60 wells which now produce from these fields a total of about 11,000 barrels daily. Fourteen gas condensate fields and a dry gas field, all of which are now shut in, also have been found. Altogether there have been drilled 66 oil wells, 22 gas condensate wells, 3 dry gas wells and 98 dry holes. Of the 113 development wells drilled, 51 have been dry holes.

Hallanan testified: "The perplexing and precarious position in which we lessees find ourselves as a result of the controversy between the states and the federal government has inevitably led to a serious decline in offshore operations. In July, 1950, there were only 4 geophysical crews operating in the entire area as compared with 40 crews operating 2 years ago. At one time a total of 23 rigs were drilling in the Gulf. Last month (July) there were 14. A year ago about 60 percent of the wells being drilled were wildcats. Today there is only one wildcat drilling in the entire area. Not a single well is being drilled off the coast of Texas. There is reason to fear that unless the existing confused situation is clarified, operations may continue to decline until they are at a complete standstill."

Mastin G. White, solicitor of the Interior Department, testified that the executive departments had always used June 23, 1947, the date of the California decision by the Supreme Court, as the "cutoff" date to be used in determining the equities of offshore lessees. Hallanan pointed out that if that date were used, it would destroy all existing leases off the Texas coast, and one-half those off Louisiana for which operators have paid $30 million. The two largest fields so far discovered in the Gulf are on leases acquired since June, 1947, and in these 2 fields are located 32 producing oil wells which produce about 9000 barrels of the total 11,000 barrels daily produced in all the Gulf.

Price Daniel, attorney general of Texas, testified that it would "be folly to interrupt the states' smooth working machinery during the present national emergency." He warned: "It has become apparent that the Interior Department would be willing to stop all operations on the submerged lands in order to gain control of this property. It is reported that the Secretary of the Interior is contemplating leasing of tidelands under purported "inherent powers" so that he may bypass the wishes of Congress and take control of this land. This in spite of specific legislation exempting the tidelands from the operations of the Minerals Leasing Act."

Rex G. Baker, general counsel for Humble Oil & Refining Company, told the senators that Resolution 195 does not validate state leases but merely authorizes the lessee to continue operations until Congress enacts permanent legislation. He said: "It is my opinion that the continued orderly development of the oil and gas deposits of the continental shelf will not be realized unless the resolution provides full and complete validation of lessee rights under state leases heretofore acquired in good faith."

Baker said Humble as of May 1, 1950, had spent $50 million in exploration, purchase of leases, payment of rentals and in drilling, equipping and operating wells on the Gulf Continental Shelf. "As of this date," he added, "the company has received revenues which aggregate about $670,000 from operations on these leases. The company spent $1.2 million in construction of a single large drilling platform; each of its 16 smaller platforms cost on the average $280,000; the attached drilling tender used in drilling from smaller platforms represents an additional investment of over $800,000. Our average cost of drilling a wildcat well on the continental shelf has been about $778,000 and our average cost of drilling a field well, about $677,000. We are currently spending about $600,000 a month on a two-rig drilling program, while our income on producing leases amounts to only $80,000 per month."

Earnings Outlook Good

Anticipated heavier corporate income taxes, due to the defense program, will restrict oil company net profits, but earnings for 1950 should compare favorably with those of 1949.

Industry earnings in first quarter were generally below last year, due to lower prices and smaller crude production. But earnings improved in second quarter, with volumes of business greater, and for the industry as a whole, earnings for first half of 1950 almost equaled those of 1949's initial half.

In this year's second half there is strong demand for oils, and earnings before taxes should be well above last year, although increased taxes may materially affect improvement in net profits.

Oil, the Farmer's Ally

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Oil chemicals also work on fungus growths which attack crops. Weeds, which can choke a plant by cutting off light and water, are particularly vulnerable to oil treatment. As in this constant war on weeds, petroleum serves the farmer in everything from sheep dip to fuel for his orchard heaters.

If the men who produce our food had been asked by the census takers to name their best "hired hand" they might well have said "Oil."

Production Nearing Capacity

■ CONTINUED FROM PAGE 41

December, 1948. The September output of about 6,332,000 barrels per day will be 984,000 a day above this year's low of 5,348,000 daily reached in March, and will consist of 4,878,000 of crude and 470,000 of natural gasoline and allied products. Another such increase in daily production as the March-September rise of 984,000 barrels, starting from the estimated September level, would almost wholly use up the September reserve producing ability of 989,677 barrels per day.

The increase of U. S. production by about 350,000 barrels per day for September as compared with July 31 reflects largely a gain of 322,000 for Texas. That state, with potential of 3,199,868 barrels daily of crude oil on July 31, raised output from 2,329,900 daily in July to about 2,463,950 in August and 2,652,000 in September, leaving in reserve now about 548,000 barrels per day. Other substantial parts of the present U. S. reserve producing ability of 989,677 barrels daily include crude oil in amounts of about 150,000 daily in California, 80,000 in Louisiana, 80,000 in Oklahoma, 35,000 in Kansas, 25,000 in Wyoming, 20,000 in New Mexico, 13,000 in Colorado, 12,000 in Mississippi, and small amounts in several other states; and about 25,000 barrels per day of natural gasoline, largely in Texas and Louisiana.

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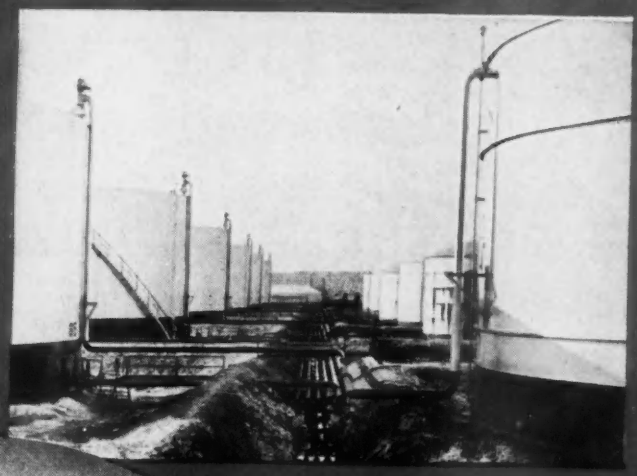

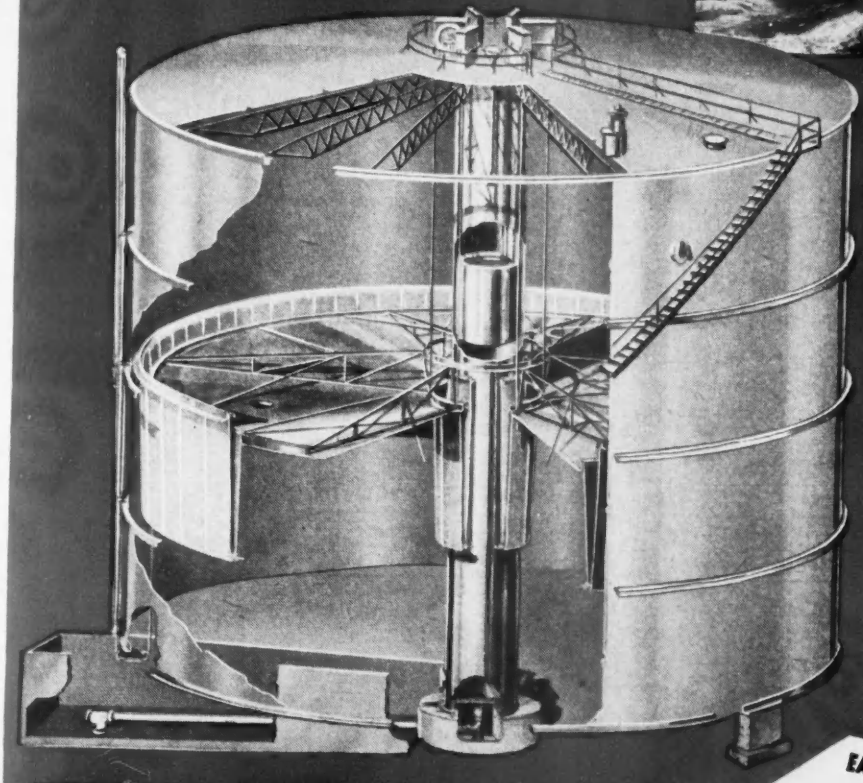

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Completions

Total Record 24,422

A RECORD number of wells were completed during July to continue the rapid drilling pace set by the industry's drillers in the year's first-half. At the end of July, total well completions numbered 24,422, which was a gain of 10.5 percent over the 22,094 made during the seven months of 1949. It was also 13.3 percent more wells than were completed in the same period of 1948, the all-time peak drilling year.

This year's activity has shown an even greater increase in the amount of footage drilled in wells. So far a total of 88,694,661 feet have been penetrated. At the same time a year ago, 79,313,244 feet had been drilled, which gave the current program an edge of 11.8 percent in the footage drilled department. Back in the record-drilling year, 1948, the seven-months' footage column added to 73,693,945 feet and a comparison showed that this year has done 20.4 percent better.

In numbers this year's drilling is ahead of any other period's. As far as succesful results are concerned its greater number of producers is holding its own with previous years on a percentage basis. So far 59.4 percent of all wells drilled for oil or gas have been completed as oil wells; a year ago the count had been 59.1 percent, and in 1948 it was 59.9 percent. The earlier years held a slight edge on natural gas wells. In this tabulation only wells seeking production were used, with all service or facility wells excluded.

Well Completions in the United States during July, 1950, and Cumulative for Year

(Figures compiled by WORLD OIL Staff from private reports and other sources as follows: Illinois from Illinois Geological Survey. Indiana from Indiana Division of Geology. Missouri from Missouri Geological Survey. Tennessee from Tennessee Division of Geology. Bradford, Kane-Clarendon and Allegany fields of Pennsylvania and New York from the *Producers Monthly*.)

STATE or DISTRICT	MONTHLY COMPLETIONS, JULY, 1950 — NEW WELLS: Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Total New	Total Drilled Deeper	TOTAL COMPLETIONS: July, 1950	June, 1950	July, 1949	Footage July, 1950	CUMULATIVE TOTAL: Wells 1950	Wells 1949	Percent Diff.	Footage 1950	Footage 1949	Rigs in Operation (Drilling, Rigging Up and Shut Down): July 31, 1950	June 30, 1950	July 31, 1949
Alabama	1			4				5		5	4	4	28,251	24	10	+ 140.0	97,782	54,659	4	11	2
Arizona				3				3		3		1	14,103	3	4	— 25.0	14,103	11,496	5	5	6
Arkansas	23			17				40		40	31	29	137,552	226	180	+ 25.6	747,410	725,691	26	34	27
California	122		4	44		1		171	13	184	150	176	695,826	1,088	1,531	— 28.9	4,409,164	6,067,439	210	259	232
Colorado	1		1	8				10	1	11	1	7	40,519	30	35	— 14.3	107,334	143,087	17	17	20
Florida											2	1		9	10	— 10.0	59,087	60,871	2		4
Georgia											1			3	4	— 25.0	13,270	12,437			1
Idaho														3			8,540		3	3	
Illinois	147		1	192				340		340	274	286	783,813	1,514	1,396	+ 8.5	3,248,794	3,480,842	274	266	221
Indiana	71		2	102		1		176		176	183	136	310,313	896	667	+ 34.3	1,549,894	1,264,984	210	190	156
Kansas	183		56	143			4	386		386	337	308	1,240,242	2,211	1,672	+ 32.2	7,140,658	5,593,909	362	350	300
Kentucky	58		22	64				144		144	117	87	253,349	630	587	+ 24.3	1,139,342	915,537	116	113	88
Louisiana	105	15	14	68			1	203	4	207	211	224	1,220,730	1,387	1,212	+ 14.4	8,433,244	6,958,067	234	243	208
North Louisiana	55	6	11	32				104	2	106	123	137	335,756	716	661	+ 8.3	2,520,522	2,188,018	75	74	69
South Louisiana	50	9	3	36			1	99	2	101	88	87	884,974	671	559	+ 21.8	5,912,722	4,770,049	159	169	139
Maryland														1			3,612		2	2	
Michigan	27		4	47				78	1	79	57	69	188,186	462	519	— 11.0	1,088,725	1,176,527	145	154	123
Mississippi	9	3		17				29	1	30	27	21	220,246	210	198	+ 6.1	1,533,110	1,469,711	26	23	28
Missouri				1				1		1	2	5	288	23	12	+ 91.7	14,585	6,064	6	6	6
Montana	6		2	4				12		12	22	44	38,229	117	141	— 17.0	321,355	377,771	42	32	54
Nebraska	4			7				11		11	9	1	47,802	48	3	+ 1500.0	197,822	11,571	12	9	3
Nevada																			1	1	
New Mexico	37		4	11				52	3	55	53	23	242,366	350	301	+ 16.3	1,551,402	1,298,254	98	103	86
New York	49				31			80		80	75	24	155,242	421	591	— 28.8	634,759	833,296	99	94	72
North Dakota																			2	1	3
Ohio	36		15	37				88	2	90	98	76	171,975	550	595	— 7.6	1,150,911	1,299,941	148	149	155
Oklahoma	254	1	37	134	2		1	429	11	440	439	356	1,559,281	3,036	2,415	+ 25.7	10,487,250	8,671,443	619	593	457
Oregon																			1	1	
Pennsylvania	56		32	8	51	8		155		155	155	129	281,802	918	1,211	— 24.2	1,665,209	2,159,107	263	260	208
South Dakota												1		1	2	— 50.0	5,710	6,905	1	1	2
Tennessee														3	14	— 78.6	3,993	14,376	9	9	6
Texas	917	17	38	451	3	1	3	1,430	25	1,455	1,413	1,224	6,160,257	9,559	8,218	+ 16.3	40,515,903	34,158,371	1,425	1,492	1,209
Dist. 1 S. Central	16			19				35	1	36	49	47	104,222	270	335	— 19.4	736,734	990,737	28	32	34
Dist. 2 Middle Gulf	31	2	6	23				62		62	69	58	361,817	378	389	— 2.8	2,185,576	2,275,304	57	62	49
Dist. 3 Upper Gulf	88	6	4	40		1		139		139	127	118	866,577	910	783	+ 16.2	5,312,436	4,821,552	129	144	114
Dist. 4 L. Gulf-S.W.	84		6	31				121		121	162	103	560,057	951	833	+ 14.2	4,537,226	4,116,739	101	117	96
Dist. 5 E. Central	7	1	1	7				16		16	23	15	75,394	114	132	— 13.6	467,232	624,066	21	25	21
Dist. 6 Northeast	39	2	1	8				50		50	45	62	256,640	361	545	— 33.8	1,726,925	2,375,210	39	32	49
Dist. 7-B N. Central	69		3	117			2	191	2	193	169	176	513,856	1,128	1,137	— 0.8	3,162,416	3,396,618	126	133	170
Dist. 7-C W.Central	49	5	2	26				82	6	88	78	50	397,315	498	260	+ 91.5	2,099,009	1,233,689	89	93	61
Dist. 8 West	331	1	1	45	1			379	16	395	353	246	2,031,541	2,422	1,651	+ 46.7	13,048,130	8,117,608	514	526	365
Dist. 9 North	157		2	129	2		1	291		291	247	282	779,631	1,966	1,501	+ 31.0	5,463,617	4,088,940	220	224	150
Dist. 10 Panhandle	46		12	6				64		64	91	67	213,207	561	652	— 14.0	1,776,602	2,117,908	101	104	100
Utah			1					1		1	1	6	2,027	10	31	— 67.7	30,434	148,515	9	8	15
Virginia																			1	1	
Washington														2			16,032				
West Virginia	15		39	6				60	5	65	41	46	174,070	364	268	+ 35.8	906,776	786,584	260	255	228
Wyoming	26			31				57		57	45	53	288,564	323	347	— 6.9	1,598,451	1,605,789	80	75	95
Total U. S.	2,147	36	272	1,399	87	11	9	3,961	66	4,027	3,748	3,337	14,255,033	24,422	22,994	+ 10.5	88,694,661	79,313,244	4,712	4,760	4,015

This region's achievement of being capable of producing an additional half a million barrels per day above its currently expanded output of one million barrels daily is the result of the American private enterprise system.

Permian Basin Symbolic Of American Enterprise

By L. J. LOGAN, Associate Editor

IT IS symbolic that the great "oil bowl" of West Texas and southeast New Mexico, developed by dynamic free enterprise, affords the U. S. an important part of its presently available reserve of oil-producing ability for resisting Communism, under which there is no private oil development and apparently no material reserve oil producing potential.

Although producing more than 1 million barrels daily in August, West Texas and southeast New Mexico have the ability to produce approximately another ½ million barrels per day from existing wells; and there is every indication that this producing ability could be further increased, through continued development, to the extent of contributing greatly to emergency requirements.

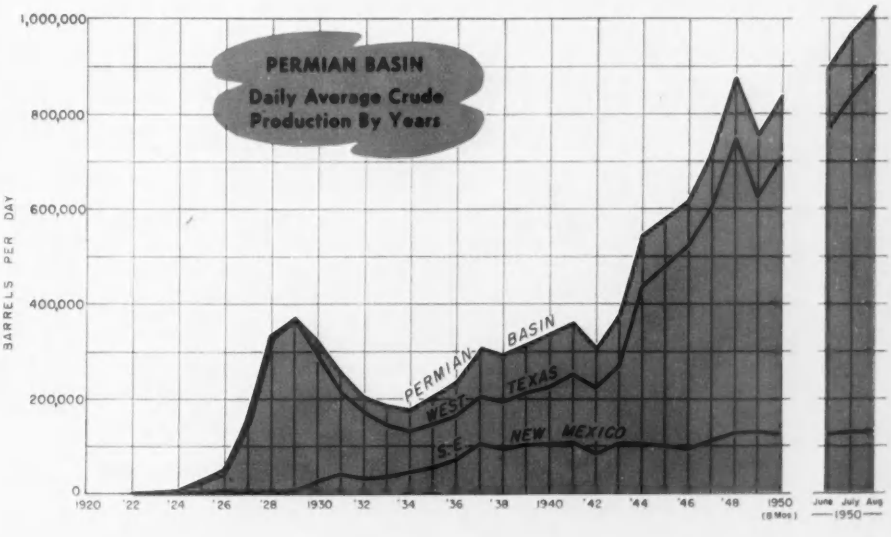
Even at the already developed potential production rate of approximately 1½ million barrels daily, the region is able to produce oil at as high a rate as current actual production in Venezuela, which is second only to the U. S. among the world's largest producing countries. Broken out of the U. S. and considered as a country, West Texas-New Mexico at present would be the world's third largest producing country, ranking after the U. S. and Venezuela, and would be one of only 3 countries producing over 1 million barrels per day. In the early part of this year, production in some of the leading foreign countries included around 675,000 barrels daily in Russia, 600,000 per day in Iran, 465,000 daily in Saudi Arabia, 305,000 daily in Kuwait, 112,000 daily in Iraq.

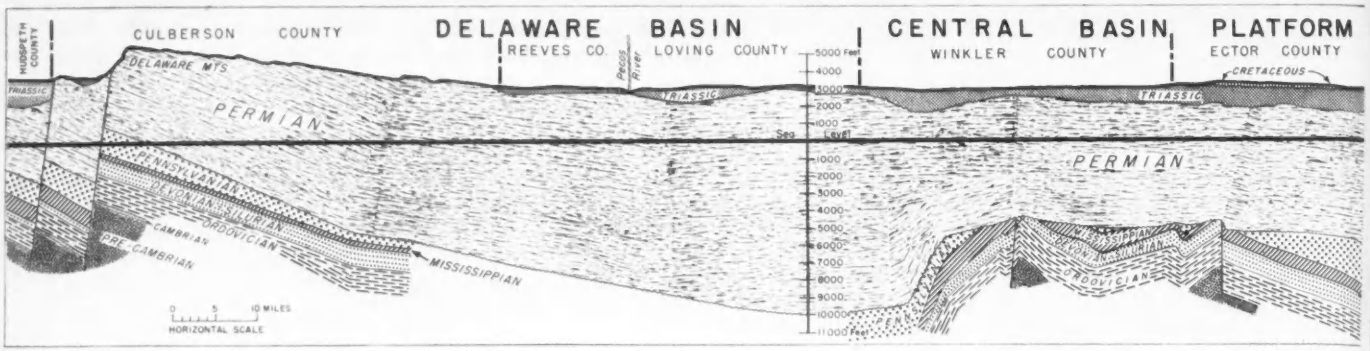
In the West Texas-southeast New Mexico region is a great geological basin, extending about 300 miles from east to west and nearly 300 miles from north to south. Through the ages the basin alternately received sediments washed in from adjacent mountains, emerged above the sea, and again became submerged and received more sediments, until there were laid down great thicknesses of formations that now are covered by semi-arid, treeless, level topsoil. Conditions were so favorable for the formation and accumulation of oil in geological traps in these sediments that virtually every formation in the geologic column, from Cretaceous near the surface down to the pre-Cambrian basement rocks, has produced oil or gas at some place and under some conditions of structure.

Among the seas that covered West Texas-southeast New Mexico were those of Permian time, and with Permian age sediments laid down widely and thick, the region came to be called by oil men the Permian Basin.

The Permian section got its name from the Russian Province of Perm, where comparable rocks outcrop. The town of Odessa, Ector County, Texas, an important oil field equipment supply center at the heart of the Permian Basin, similarly got its name from Russia, having been named after Odessa, Russia, when founded in 1886 by Russian-German colonists, who visualized the surrounding plains as a great wheat country like that around Odessa, Russia. In connection with Permian Basin oil development, these names represent, however, all that is suggestive of Russia.

The Permian Basin oil industry has been developed in American tradition. Thirty years ago West Texas had no oil and, in the opinion of many, no prospects of oil. But a few wildcatters risked their limited capital to drill wells, as early ranchers had put their limited funds into cattle lands. Finally, oil was found in several places, and development of the oil of the region got under way. More operators became interested and entered the area as additional fields were discovered. There were many dry holes and financial casualties, as





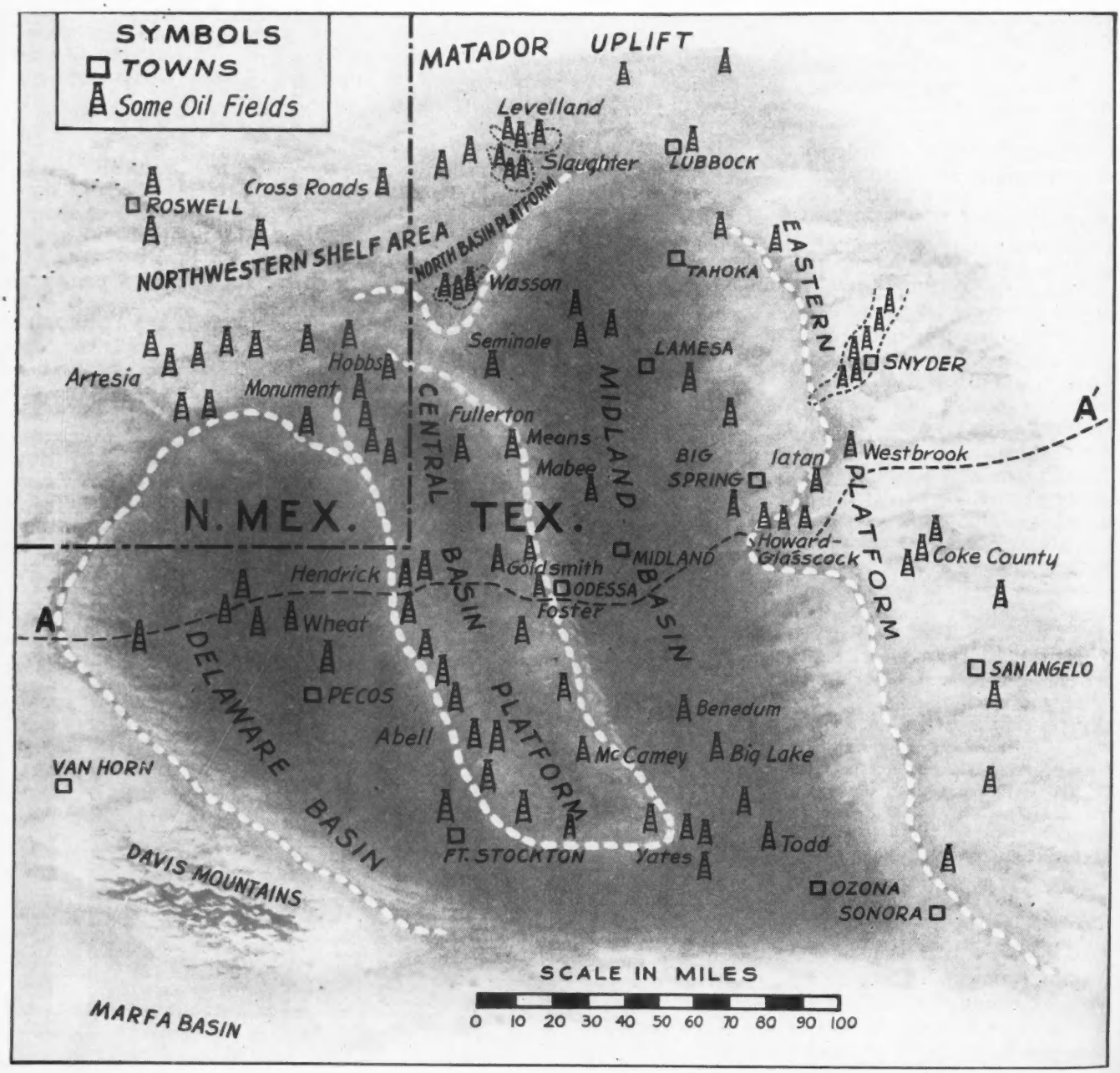
BELOW: The Permian Basin, "oil bowl" of West Texas and Southeast New Mexico, which extends about 300 miles from west to east and nearly 300 miles from north to south. In ancient times this former great depression of the earth was covered by seas, in which were laid down great thicknesses of sediments that now give up oil.

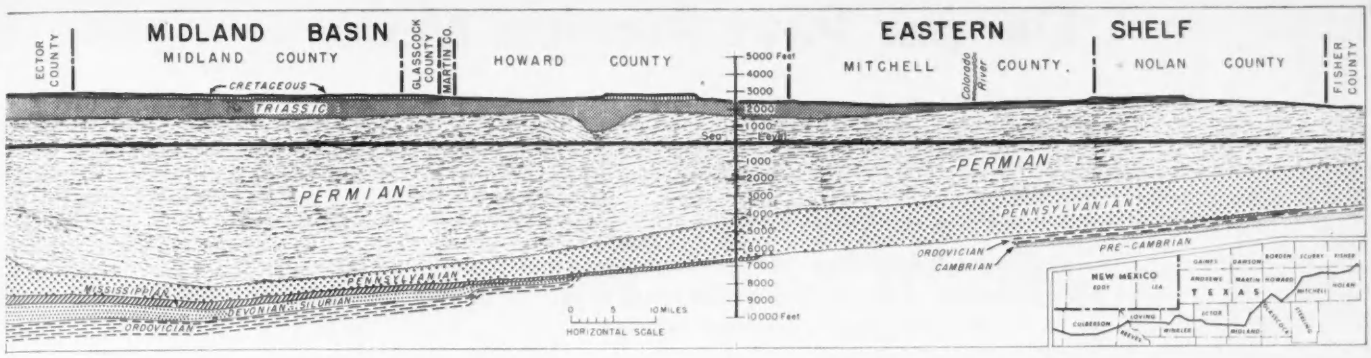
Deeper parts of the basin were sinks known as Midland, Delaware and Marfa Basins, connected on the south by deep "channels." Shallower parts were around eastern and northern edges and along the Central Basin Platform, a "peninsula" jutting down from the north into the middle of the basin to separate it into two parts, Midland Basin on the east and Delaware Basin on the west.

ABOVE: Geological cross-section from west to east across central portion of Permian Basin. Sands and limes of thick Permian section, yielding mostly high sulfur content or sour crudes, formerly accounted for over 95 percent of West Texas-Southeast New Mexico production. But pre-Permian (or sub-Permian) formations, yielding mostly higher gravity, sweet crudes, now account for about one-third of total production.

Route of cross-section is shown on small index map at extreme lower-right side on the opposite page, and also on regional map below as dashed line A—A'.

This illustration is based on a more detailed cross-section prepared by Stratigraphic Problems Committee of West Texas Geological Society.





the geology of the region was not simple, with sub-surface conditions largely unrelated to the surface geology. The sub-surface had to be learned laboriously and at great cost, with many operators putting their time, knowledge, imagination, and money into the effort.

Since sub-surface geology was the most effective method of exploration for oil fields in the area, operators established organizations and laboratories to utilize information and samples from wells that were drilled. In the spirit of cooperation for mutual advantage, the Permian Basin oil operators and scouts freely interchanged information and samples, and clearer understanding of the geology developed as rapidly as more wells were drilled. In seeking more complete understanding of the geology and structural conditions, the companies widely employed not only surface and sub-surface geology but also all other available exploration techniques, including chemical surveys, gravity meters, seismograph crews, paleontology, and research in stratigraphy.

Following the drilling of thousands of wells, discovery of hundreds of oil fields, and production of 3½ billion barrels of oil, the Permian Basin now has more proved, unproduced oil reserves than ever before, totaling at least 6 billion barrels, or more than 20 percent of all U. S. reserves. Yet production and development are still increasing to new highs with additional oil being found in new places and at deeper horizons in older fields. A great deal has been learned about the conditions of oil accumulation beneath these Western plains, but more is being learned steadily, and perhaps additional billions of barrels of oil still await discovery, as suggested by the fact that the new Scurry County fields alone are expected to produce substantially more than 1 billion barrels from the prolific Pennsylvanian reef.

A map of West Texas-southeast New Mexico as of 1920 could show not a single oil field, the first field having been Westbrook in Mitchell County, opened in 1921. An oil map of the same region as of the middle of 1950 shows nearly 300 fields having production. Similarly, instead of nebulous or rough and general geologic maps and cross-sections that could be drawn from available information of 1920, there are now, in 1950, contour maps and cross-sections showing in much detail the geological and structural conditions underlying West Texas and southeast New Mexico, in unproductive as well as productive areas, based on what was found in thousands of wells.

In a period of approximately 30 years, the operators in the Permian Basin have proved up in all nearly 10 billion barrels of oil, including the 3½ billion already produced and about 6 billion proved but yet to be produced. This is about a third as much oil as the presently available proved reserves of the nation.

The oil men's achievement in the Permian Basin, considering the difficulties and complexities involved, has been almost incredible. Probably nowhere else in the world and by no other means than the American private enterprise system could so much oil be developed in so short a time and under such geological conditions. The oil that was there was difficult to find, and it was financially hazardous to try to discover it. But in the hope of rich reward, small and large fortunes were risked; and with many men and companies risking their capital to test out their ideas, some of them succeeded, and then others, until the development finally has reached its present remarkable status.

Over the years, crude production in the Permian Basin has been expanded greatly, despite some temporary declines, as shown in a chart and a table herewith. From zero to

• CONTINUED ON PAGE 66

Crude Oil Production in West Texas and Southeast New Mexico, by Years

Sources: Private sources, Texas Railroad Commission, American Petroleum Institute.
Data in Barrels

YEAR	WEST TEXAS Total	WEST TEXAS Daily	SOUTHEAST NEW MEXICO Total	SOUTHEAST NEW MEXICO Daily	TOTAL PERMIAN BASIN Total	TOTAL PERMIAN BASIN Daily
1921	*	*	.....	.....	*	*
1922	34,010	93	.....	.....	34,010	93
1923	184,570	506	.....	.....	184,570	506
1924	1,539,895	4,207	40,000	109	1,579,895	4,316
1925	9,783,760	26,805	797,859	2,186	10,581,619	28,991
1926	15,325,244	41,987	1,097,373	3,006	16,422,617	44,993
1927	52,447,026	143,690	632,624	1,733	53,079,650	145,423
1928	119,415,821	326,273	709,643	1,939	120,125,464	328,212
1929	133,278,558	365,147	1,351,666	3,703	134,630,224	368,850
1930	108,182,664	296,391	9,924,331	27,190	118,106,995	323,581
1931	77,578,928	212,545	14,750,831	40,413	92,329,759	252,958
1932	63,085,662	172,365	11,911,538	32,545	74,997,200	204,910
1933	54,166,358	148,401	13,630,263	37,343	67,796,621	185,744
1934	48,452,540	132,747	16,440,434	45,042	64,892,974	177,789
1935	54,010,861	147,975	19,843,843	54,367	73,854,704	202,342
1936	60,574,724	165,505	26,422,595	72,193	86,997,319	237,698
1937	74,720,000	204,712	37,968,000	104,022	112,688,000	308,734
1938	71,405,918	195,633	35,175,892	96,372	106,581,810	292,005
1939	78,449,766	214,931	36,971,183	101,291	115,420,949	316,222
1940	83,726,278	228,760	38,574,827	105,396	122,301,105	334,156
1941	92,454,962	253,301	39,263,953	107,572	131,718,915	360,873
1942	81,186,222	222,428	31,568,860	86,490	112,755,082	308,918
1943	98,095,759	268,755	38,487,893	105,446	136,583,652	374,201
1944	160,102,690	437,439	39,068,737	106,745	199,171,427	544,184
1945	175,406,050	480,564	36,857,998	100,981	212,264,048	581,545
1946	190,888,474	522,982	35,282,263	96,664	226,170,737	619,646
1947	219,957,007	602,622	40,570,080	111,151	260,527,087	713,773
1948	274,032,304	748,722	47,236,961	129,063	321,269,265	877,785
1949	227,575,247	623,494	47,566,000	130,318	275,141,247	753,812
1950: 8 Mos.	172,928,468	711,640	30,885,600	127,101	203,814,068	838,741
Total to Sept. 1, 1950	2,798,989,766	.....	653,031,247	.....	3,452,021,013	.....
Recent Mos.:						
June, 1950	23,093,100	769,770	3,747,900	124,930	26,841,000	894,700
July, 1950	25,999,700	838,700	4,051,700	130,700	30,051,400	969,400
†Aug., 1950	27,741,900	894,900	4,051,700	130,700	31,793,600	1,025,600

* Small production, but no record available. † Estimated.

Deeper Pays Provide More Sweet Crude In Permian Basin

This once predominantly sour crude producing area now is yielding an increasingly large amount of sweet crude as the result of successful deeper production search in recent years. New discoveries indicate vast reserves of sweet crude.

By L. J. LOGAN, Associate Editor, and CECIL W. SMITH, Statistical Editor

ASIDE from increasing total reserves and production, development in the Permian Basin of West Texas and Southeast New Mexico during recent years has been significant and gratifying in that it has provided increased proportions of production classed as "sweet" crude, which is of greater market value than the high sulfur content or "sour" crudes that formerly were more predominant in the area.

The change has taken place through development of increased production from lower Permian and pre-Permian formations, which yield crude of relatively low sulfur content, in contrast with the high sulfur content crudes commonly found in the upper and middle sections of the Permian in much of the development of the past.

The new era of increased production of sweet crude has been brought about primarily by deeper drilling, which has opened production from lower Permian and pre-Permian formations not only in older fields but also in new fields.

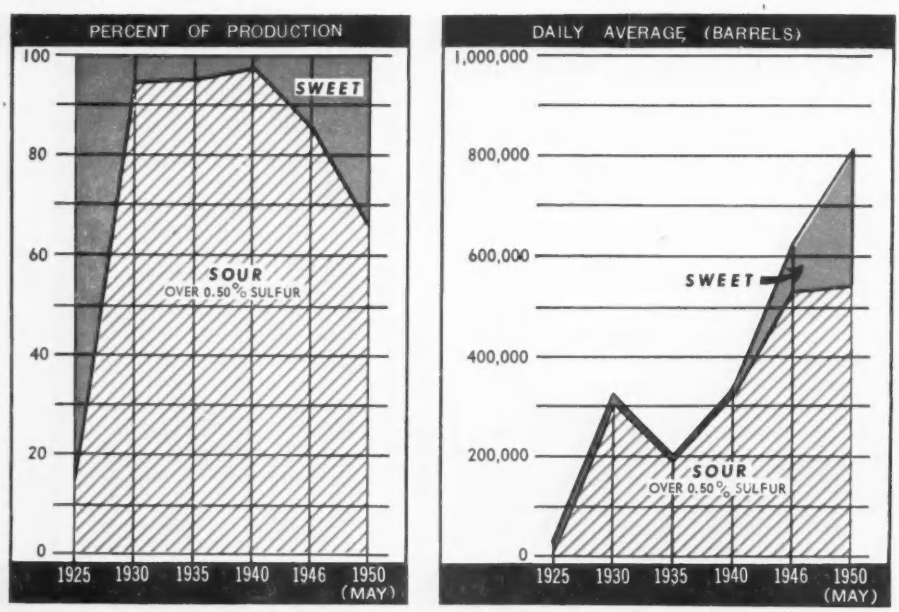
For about the past 2 years, there have been approximately the same number of discoveries in the lower permian and pre-Permian as in the upper sections of the Permian. Considering the vast reserves lately discovered and in prospect in the Pennsylvanian reefs in Scurry County and elsewhere, it is indicated that recent and prospective sweet crude discoveries materially exceed sour crude discoveries in importance, as measured by the number of barrels of oil involved.

The greater desirability and market value of the sweet crudes now being developed are based not only on the lower sulfur content, which makes handling and refining less expensive, but also on the generally higher gravity of the sweet crudes and their higher yield of gasoline and other valuable lighter products when refined.

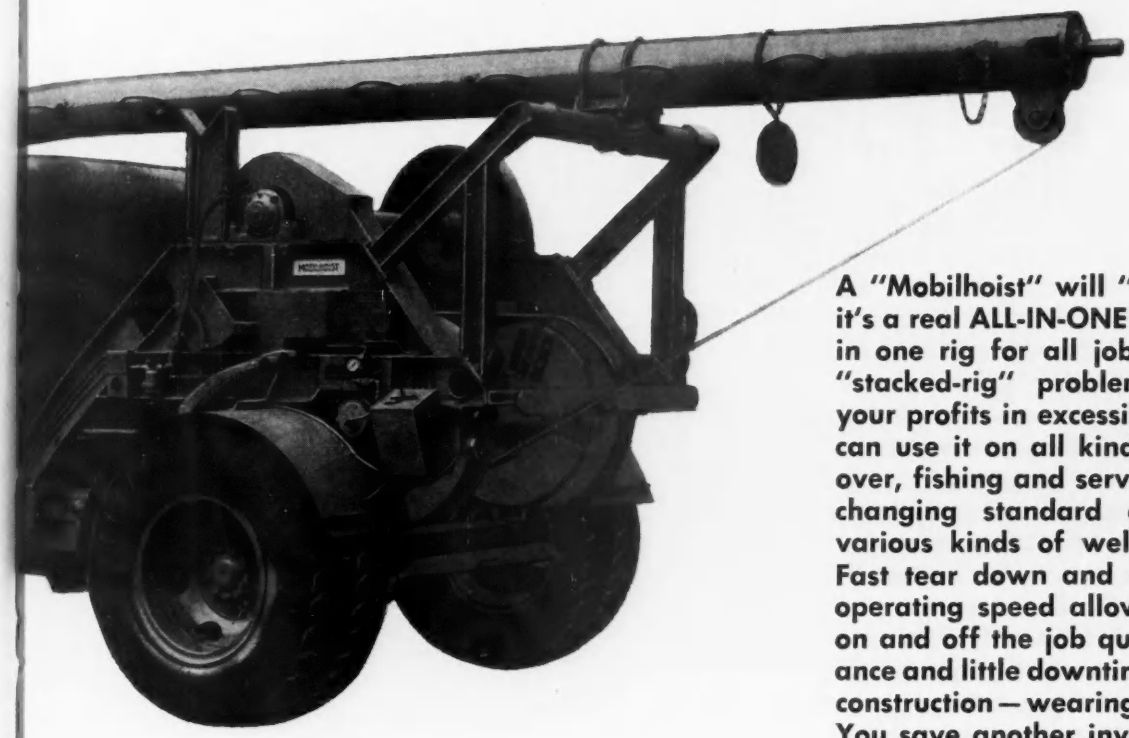
The Permian Basin was a predominantly sweet crude area in its early stages, extending through 1925, with relatively small production from the Pennsylvanian and other sections yielding low sulfur oils. But 1926 brought numerous discoveries of major fields, such as Yates, Hendrick, McCamey, Todd, and McElroy, that produced high sulfur content crude from upper and middle Permian formations, and thereafter sour crude greatly predominated in the district's production.

In studies of high sulfur crude oils in the U. S., the Bureau of Mines has classed crudes having up to 0.5 percent sulfur content as low sulfur crudes and those containing more than 0.5 percent as high sulfur. In the period 1935-40 less than 5 percent of West Texas-New Mexico production was low sulfur crude of less than 0.5 percent sulfur content, and more than 95 percent was high sulfur crude (about 5 percent having 0.5 to 1 percent sulfur, 70 percent having 1 to 2 percent, and 20 percent having 2 percent or more). By 1946, due especially to important production from the Ellenburger, Ordovician age, about 15 percent of West Texas-New Mexico production was crude of less than 0.5 percent sulfur content (about 5 percent having 0.26 to 0.50 percent sulfur and 10 percent having 0 to 0.25 percent sulfur). Meanwhile, in 1946, only about 85 percent of the district's production was crude of more than 0.5 percent sulfur content (about 13 percent having 0.5 to 1 percent sulfur, 60 percent having 1 to 2 percent, and 12 percent having 2 percent or more).

Since 1946 there have been numerous discoveries in lower Permian



West Texas-Southeast New Mexico sour and sweet crude production trend.



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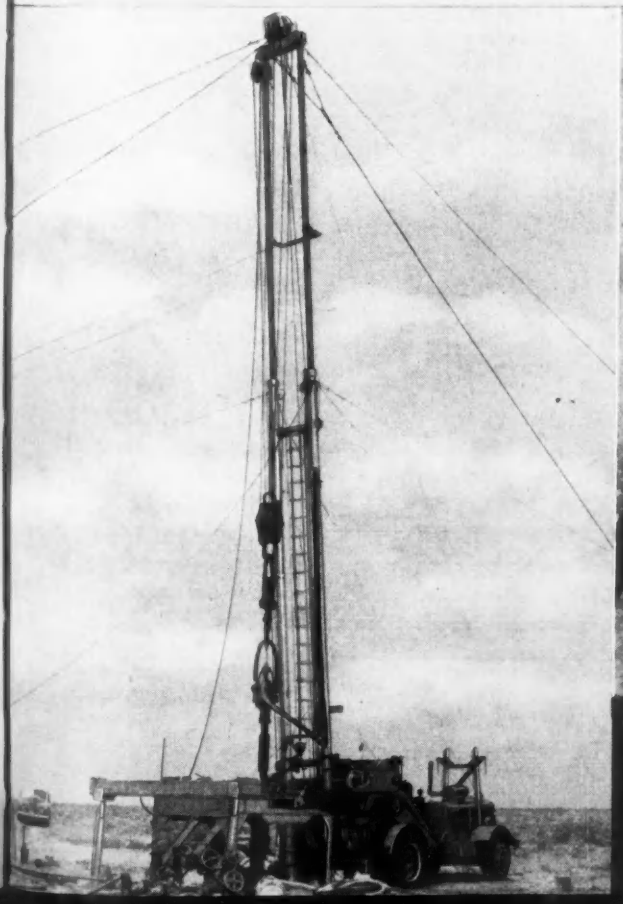

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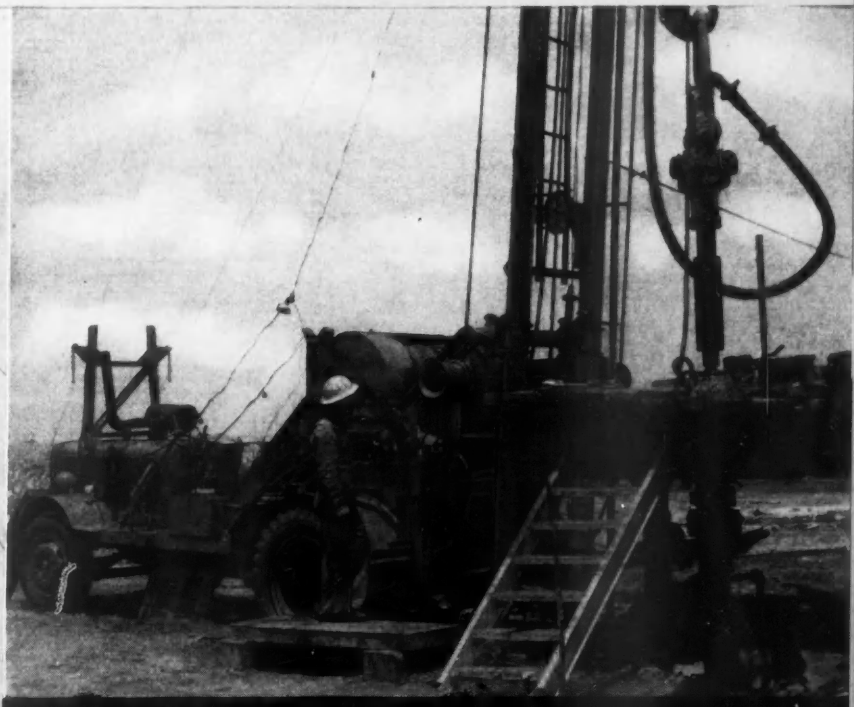

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and pre-Permian formations, which have further increased the percentage of production representing low sulfur crude, at the same time bringing down further the percentage composed of high sulfur crudes. Currently, it is indicated that about 34 percent of the district's production is in the low sulfur groups and about 66 percent in the high sulfur classifications. (West Texas now has about 35 percent sweet crude production and 65 percent sour, while Southeast New Mexico has about 25 percent sweet and 75 percent sour.) Moreover, the proportion of sweet crudes appears likely to increase further through development of the Pennsylvanian reef fields and the pre-Permian pay zones in other fields.

As a rule, pre-Permian formations in West Texas and Southeast New Mexico yield high gravity sweet crude, although such pays as Devonian and Silurian in some cases have as much as 0.7 or 0.8 percent sulfur.

Clear Fork lime, lower Permian, yields high gravity sweet crude in some West Texas fields, including more than 25,000 barrels per day of 43 gravity oil, 0.48 percent sulfur, at Fullerton field. However, the Clear Fork also produces considerable medium gravity sour crude, more than 1.0 percent sulfur, in some other West Texas fields, including Embar, Howard-Glasscock, Monahans, Wasson, and Westbrook.

New Mexico's Yeso (Drinkard) zone of lower Permian consistently yields high gravity sweet crude, including about 20,000 barrels per day of 40 gravity oil, 0.10 percent sulfur, at Drinkard field.

Permian Basin formations of middle and upper Permian and Cretaceous age consistently yield sour crude of over 0.5 percent sulfur content.

While the proportion of Permian Basin production with low sulfur content has been increasing, the proportion representing higher gravity crude also has been gradually increasing, thereby raising the average gravity of the crude production of the district. In the period 1935 through 1940, Permian Basin crude averaged approximately 33 gravity, it is indicated by records on posted prices and Bureau of Mines figures on value of crude produced. In 1945 the average gravity was about 34, and in 1947 it apparently was up to about 37. At present the average gravity probably is still higher and further increasing, due especially to the development of the Pennsylvanian

Producing Wells and Crude Oil Production in Permian Basin, by Formations

(Texas data as of May, 1950; New Mexico as of January, 1950)

System and Series	Group	WEST TEXAS Formation	WELLS Flowing	WELLS Art. Lift	WELLS Total	Bbls. Daily Prod.	S. E. NEW MEXICO Formation	WELLS Flowing	WELLS Art. Lift	WELLS Total	Bbls. Daily Prod.	PERMIAN BASIN Formation	WELLS Flowing	WELLS Art. Lift	WELLS Total	Bbls. Daily Prod.
Cretaceous: Comanche	Trinity	Paluxy	40	727	767	5,889	.....	.....	.....	.....	.....	Paluxy	40	727	767	5,889
Permian: Ochoa	Ochoa	Rustler	.....	3	3	68	.....	.....	.....	.....	.....	Rustler	.....	3	3	68
Guadalupe	White horse (Delaware Mt.)	Tansill Yates Seven Rivers Queen Grayburg	7,114	13,085	20,199	340,018	Yates Seven Rivers Queen Grayburg	2,591	2,273	4,864	93,567	Tansill Yates Seven Rivers Queen Grayburg	9,705	15,358	25,063	433,585
		San Andres					San Andres					San Andres				
	San Andres	Glorieta	348	245	593	18,469	Glorieta	79	27	106	4,475	Glorieta	427	272	699	22,944
		*	10	593	603	5,305	.....	.....	.....	.....	.....	*	10	593	603	5,305
Leonard	Leonard	Clear Fork	1,133	814	1,947	69,190	Yeso	352	28	380	18,802	Leonard	1,490	881	2,371	89,270
		Wichita	5	39	44	1,278										
Wolfcamp	Wolfcamp	Wolfcamp	33	20	53	2,244	Abo-Hueco	3	.....	3	115	Wolfcamp-Abo	36	20	56	2,359
Pennsylvanian:	Cisco	Cisco	12	74	86	2,382	Cisco	6	3	9	768	Cisco	1,233	326	1,559	103,122
	Canyon	Canyon	974	154	1,128	84,580	Canyon					Canyon				
	Strawn	Strawn	220	85	305	14,765	Strawn					Strawn				
	Bend	Bend	2	4	6	30	Bend					Bend				
	.....	†	19	6	25	597	.....									
Mississippian:	Mississippian	Mississippian	2	2	4	79	Mississippian	.....	.....	.....	.....	Mississippian	2	2	4	79
Devonian:	Hunton	Devonian	550	145	695	43,087	Devonian	15	1	16	1,782	Devonian	565	146	711	44,869
Silurian:		Fusselman	113	23	136	9,088	Fusselman	2	.....	2	94	Fusselman	115	23	138	9,182
Ordovecian: Cincinnatian	Upper Ord.	Montoya	.....	.....	.....	.....	Montoya	2	.....	2	135	Montoya	2	.....	2	135
Champlainian	Simpson (Mid. Ord.)	McKee	35	14	49	2,685	Mckee	25	4	29	1,999	Simpson	148	43	191	7,732
		Waddell	27	12	39	1,169	Waddell									
		‡	61	13	74	1,879	.....									
Canadian	.....	Ellenburger	723	125	848	79,979	Ellenburger	73	7	80	8,420	Ellenburger	796	132	928	88,399
Cambrian:	.....	Cambrian	.....	.....	.....	.....	Cambrian	.....	.....	.....	.....	Cambrian	.....	.....	.....	.....
Summary by Systems:		Percent of Prod.					Percent of Prod.					Percent of Prod.				
Total, All Pays		100.0	11,421	16,183	27,604	682,781	100.0	3,148	2,343	5,491	130,157	100.0	14,569	18,526	33,095	812,938
Cretaceous-Permian		64.8	8,683	15,526	24,209	442,461	89.9	3,025	2,328	5,353	116,959	68.8	11,708	17,854	29,562	559,420
Cretaceous-Upper Permian		54.2	7,512	14,653	22,165	369,749	75.3	2,670	2,300	4,970	98,042	57.5	10,182	16,953	27,135	467,791
Lower Permian (Clear Fork, etc.)		10.6	1,171	873	2,044	72,712	14.6	355	28	383	18,917	11.3	1,526	901	2,427	91,629
Pre-Permian		35.2	2,738	657	3,395	240,320	10.1	123	15	138	13,198	31.2	2,861	672	3,533	253,518
Pennsylvanian		15.0	1,227	323	1,550	102,354	0.6	6	3	9	768	12.7	1,233	326	1,559	103,122
Mississippian-Devonian-Silurian		7.6	665	170	835	52,254	1.4	17	1	18	1,876	6.7	682	171	853	54,130
Ordovician		12.6	846	164	1,010	85,712	8.1	100	11	111	10,554	11.8	946	175	1,121	96,266

* Glorieta and Clear Fork; division not available. † Pennsylvanian unclassified. ‡ Abell field, Pecos Co. (McKee, Waddell, Ellenburger).

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reef fields, with the Kelly-Snyder area of Scurry County alone now producing over 80,000 barrels per day of sweet crude averaging around 43 or 44 gravity.

Permian Basin crude is purchased on 3 gravity scale schedules. Sour crude below 20 gravity was priced in mid-August, 1950, at $2.10 per barrel, 20-20.9 gravity at $2.12, and the price was 2 cents more for each degree of gravity up to a top price of $2.52 for 40 gravity and above. A second schedule adds 6 cents to the above sour crude prices and applies mainly to lower Permian, Pennsylvanian reef, and other pre-Permian pays except Ellenburger. A third schedule, 13 cents above sour crude prices, applies mostly to Ellenburger (Ordovician) crude.

Permian Basin

■ CONTINUED FROM PAGE 59

1 million barrels per day in 30 years is the story that the records tell. And the trend continues sharply upward, with fields even now having ability to produce 1½ million barrels per day without damage to reservoirs.

Big-time production began in 1926, with discovery of Yates, Hendrick, McCamey, Todd, McElroy, and other major fields yielding sour crude from Permian zones. After reaching 368,000 barrels daily in 1929, production declined to around 200,000 barrels per day in the early 1930's because of the depression and competition of the East Texas field's sweet crude. The late '30s and 1940-1941 brought improved markets and gradual climb of production toward the 1929 peak.

After 1942, production increased sharply in response to urgent wartime and postwar demand for crude, with new fields and deeper pay zones steadily expanding producing ability and adding substantial volumes of sweet crude to available supply. Output averaged more than 875,000 barrels per day in 1948.

In the business decline and oil industry readjustment of 1949, Permian Basin production dropped almost to 750,000 barrels daily. But for the first 8 months of 1950, output has averaged about 838,000 barrels daily, which is fairly close to the 1948 peak, and for the full year 1950, the average promises to exceed 1948 and set a new record. In June of this year, production was up almost to 900,000 barrels daily. In July it rose further to about 969,000 daily, and for August it likely will exceed 1 million barrels per day for the first time in history.

Producing Wells and Daily Average Crude Production of Permian Basin Fields, by Producing Formations, Listed from Surface Downward

WEST TEXAS FIELDS

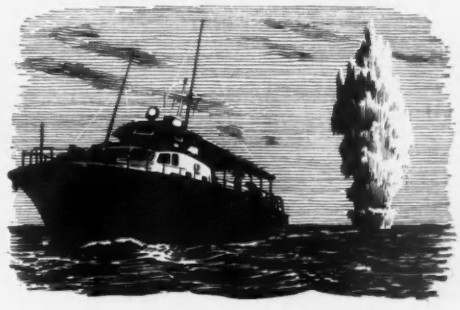
(Data as of May, 1950)

County, Field	PRODUCING OIL WELLS Flowing	Art. Lift	Total	Bbls. Daily Prod.
CRETACEOUS PAYS				
Pecos Co.: Tobarg	40	727	767	5,889
PERMIAN PAYS				
Rustler Sand				
Pecos Co.: Oates		3	3	68
Tansill Sand				
Pecos Co.: Ft. Stockton	1	1	2	58
Yates Sand				
Pecos Co.: Lehn-Apco 1600'	27	7	34	389
Netterville	7	5	12	48
Orient		5	5	25
Pecos Valley, H. G.	121	120	241	1,745
Pecos Valley, L. G.	9	51	60	150
Yates-Smith Sd		21	21	157
Ward Co.: Byrd	1	6	7	44
Payton	2	98	100	364
Sealy, S.	7	7	14	163
Winkler Co.: Eaves		20	20	548
Scarborough	17	100	117	503
Total, Yates Sand	191	440	631	4,136
Yates-Seven Rivers				
Pecos Co.: Ft. Stockton	50	27	77	788
Ward Co.: Magnolia-Sealy		39	39	146
Pyote	2		2	34
Spencer	3	10	13	124
Ward-N. Estes	306	618	924	7,307
Ward, S.	16	411	427	2,618
Winkler Co.: Emperor	61	31	92	711
Halley	21	35	56	522
Henderson	27	46	73	741
Hendrick	16	191	207	3,429
Kermit	46	469	515	2,095
Leck		20	20	515
Total, Yates-Seven Rivers	548	1,897	2,445	19,030
Seven Rivers Sand				
Crockett Co.: Noelke	5	33	38	186
Simpson		8	8	32
Pecos Co.: Jamison-Pollard		3	3	8
Shearer		38	38	113
Ward Co.: Magnolia-Sealy, S.	8	9	17	269
Total, Seven Rivers	13	91	104	608
Seven Rivers-Queen				
Pecos Co.: Fromme	4	8	12	40
Lehn-Apco, 1600'	28	56	84	254
Masterson		22	22	103
Ward Co.: Shipley	10	141	151	1,286
Winkler Co.: Emperor, Deep	13	30	43	197
Total, Seven Rivers-Queen	55	257	312	1,880
Queen Sand				
Crockett Co.: Clara Couch	1	45	46	545
Cox		2	2	6
Hoover	3	2	5	24
Gaines Co.: Hobbs, East		2	2	40
Pecos Co.: White & Baker	52	26	78	588
Reagan Co.: Big Lake	5	180	185	2,763
Ward Co.: Dobbs		1	1	4
Winkler Co.: Keystone-Colby	107	242	349	2,391
Weiner-Colby	39	22	61	334
Total, Queen Sand	207	522	729	6,695
Queen-Grayburg				
Crockett Co.: Vaughn	45	60	105	2,226
Pecos Co.: Walker	29	63	92	593
Total, Queen-Grayburg	74	123	197	2,819
Grayburg Lime				
Andrews Co.: Mabee		94	94	2,320
Means	67	158	225	3,575
Midland Farms	2	87	89	5,527
Crane Co.: Crane-Cowden	4	59	63	251
Edwards	6	34	40	410
Gib		5	5	36
McElroy	29	850	879	18,765
Waddell Ella		15	15	198
Crockett Co.: Crockett	2	70	72	458
Lancaster Hill		2	2	5
Shannon		3	3	3
World		147	147	3,948
Ector Co.: Cowden, N.	251	420	671	13,404
Cowden, S.	54	257	311	7,779
Foster	26	625	651	13,945
Johnson	17	108	125	1,209
Howard Co.: Moore		13	13	74
Pecos Co.: Shearer, 1700'		2	2	39
T.C.I.-Grayburg	1		1	2
Upton Co.: Hurdle		12	12	32
McCamey		881	881	9,951
Webb-Ray		1	1	8
Winkler Co.: Scarborough, N.	16	3	19	383
Total, Grayburg Lime	475	3,846	4,321	82,322
Grayburg-San Andres				
Andrews Co.: Fuhrman-Mascho	38	247	285	3,514
Crane Co.: Dune	2	74	76	1,245
Waddell	124	44	168	2,669
Crockett Co.: Olson		51	51	604
Pecos Co.: Yates	513	83	596	25,349
Winkler Co.: Keystone Lime	28	87	115	693
Total, Grayburg-San Andres	705	586	1,291	34,074
San Andres Lime				
Andrews Co.: Emma	1	80	81	1,544
Fullerton		1	1	11
Martin	2	11	13	50
Parker		5	5	55
Cochran Co.: Landon		13	13	623
Rhodes		1	1	10
Crane Co.: C-Bar	5	5	10	210
Jordan, 4500'	2	4	6	131
Sand Hills-Mc-Knight	31	22	53	1,774
Crockett Co.: Block 47, Shallow		7	7	17
Shannon		38	38	518
Wyatt		1	1	13
Dawson Co.: Spraberry		11	11	108
Welch	2	169	171	2,881
Ector Co.: Goldsmith	893	152	1,045	15,755
Goldsmith, N.	1	8	9	46
Harper	3	183	186	714
Lawson-San Andres		1	1	35
Penwell	49	135	184	1,875
Gaines Co.: Adair		111	111	2,439
Cedar Lake	1	101	102	3,239
Seminole	293	39	332	12,800
Seminole, W.	39	2	41	1,802
Garza Co.: Buenos		9	9	178
Dorward		5	5	145
Garza	3	339	342	8,024
P. H. D.		7	7	116
Glasscock Co.: Carter		1	1	7
Hockley Co.: Levelland	448	1,031	1,479	28,293
Slaughter	1,532	702	2,234	32,557
Yellowhouse	1	42	43	836
Pecos Co.: Abell, N.	4		4	192
Abell-U. Perm	1		1	3
Abell, 2200'		12	12	95
T.C.I.-San Andres	4	1	5	236
Reagan Co.: Grayson		6	6	58
Scurry Co.: Clark		14	14	225
Sharon Ridge, 1700'	8	525	533	3,077
Terry Co.: Alex	1	3	4	47
Tom Green Co.: Water Valley		4	4	69
Yoakum Co.: Brahaney		2	2	19
Ownby	21	27	48	725
Waples Platter		14	14	126
Wasson	1,362	247	1,609	45,949
West		1	1	15
Total, San Andres Lime	4,707	4,092	8,799	167,642

How jobs were created

How hundreds of businesses were helped

How a new source of oil was tapped



The story behind deepwater oil

A few years ago, a test well proved there is oil under the great Continental Shelf that extends out into the Gulf of Mexico, and although the well did not produce much, it started one of the most unusual—and expensive—drilling programs in history.

So far, in the search for underwater oil, seven drilling platforms have been built, similar to the one above, as far as 10 miles offshore and in water as much as 65 feet deep. They are set on tubular steel pilings driven 250 feet through the ocean's bottom, for they must be strong enough to withstand Gulf hurricanes.

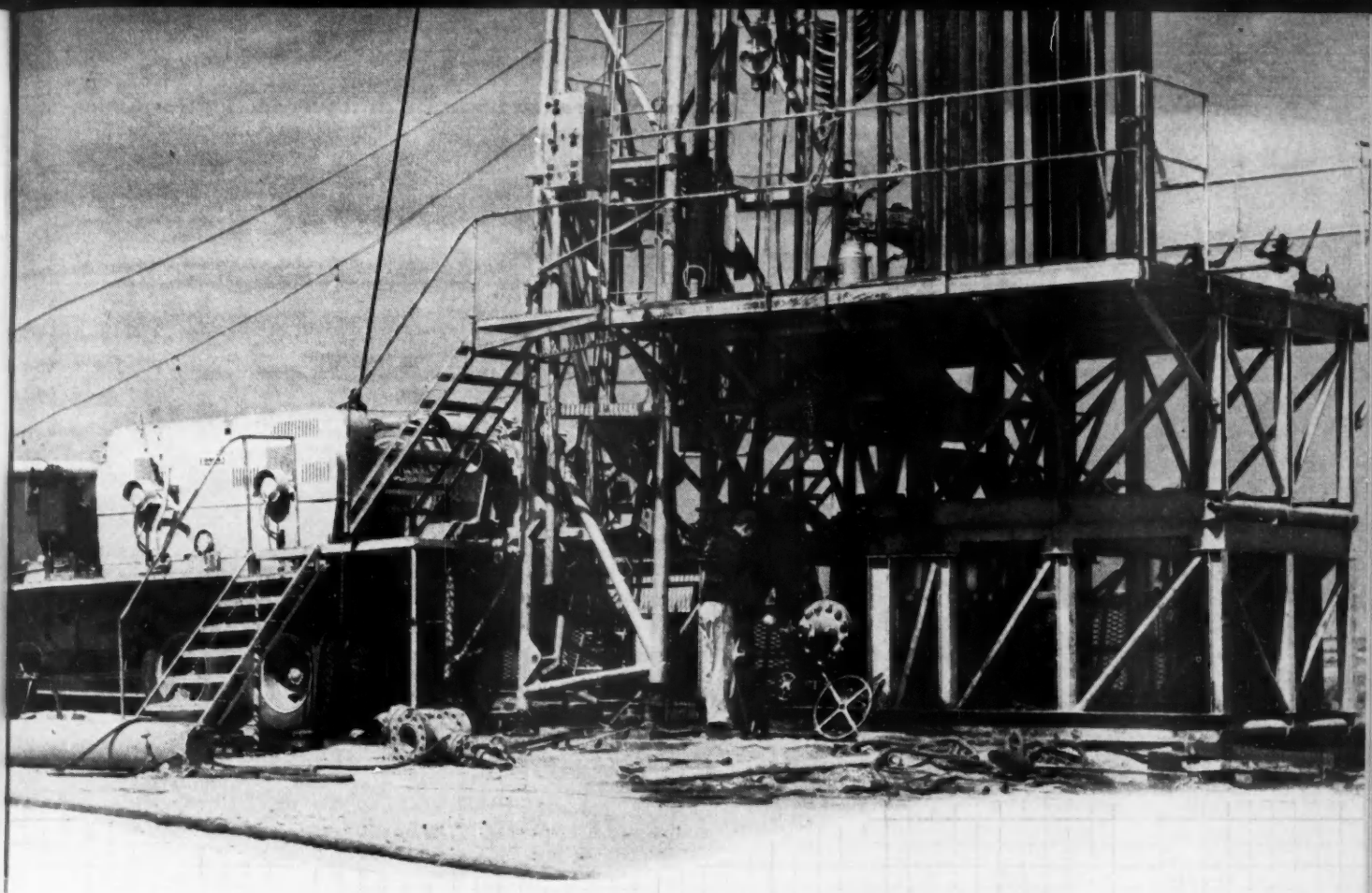
The story behind this operation is the story of risk... and of determination to do everything possible to find oil for the growing needs of motorists, farms and industries. Each underwater field costs millions of dollars more than any of equal size drilled on land, and although oil has been found, not enough has been produced yet to repay more than a small fraction of the costs.

Meanwhile, the money being risked is creating many jobs, spreading to hundreds of large and small businesses . . . and helping to keep our economy free, competitive and strong.

Producing Wells and Daily Average Crude Production of Permian Basin Fields, by Producing Formations, Listed from Surface Downward

(CONTINUED)

County, Field	PRODUCING OIL WELLS Flowing	Art. Lift	Total	Bbls. Daily Prod.
Delaware Mountain Group Undivided (Tansill, Yates, Seven Rivers Queen, Grayburg, San Andres)				
Howard-Glasscock Co.: Howard-Glasscock		985	985	15,820
Loving Co.: Mason	4	8	12	284
Wheat	15	67	82	673
Pecos Co.: Chancellor	4	2	2	28
Malicky	4	1	5	72
Taylor-Link	5	147	152	769
Reeves Co.: Charman	13	7	20	339
Dixieland	4	3	7	45
Tunstill	85	9	94	2,507
Ward Co.: Lion	1	1	2	33
Monroe	6		6	183
Scott	1		1	1
Total, Del. Mt. Undvd	138	1,230	1,368	20,754
Total, Delaware Mt. (Tansill thru San Andres)	7,114	13,085	20,199	340,018
Glorieta Lime				
Andrews Co.: Clabberhill		2	2	29
Deep Rock		1	1	42
Crane Co.: Crossett, 3200'		2	2	1
Hobbs, E., 5900'		1	1	108
Jordan	99	134	233	4,042
Sand Hills, W		5	5	58
Ector Co.: Cowden, N. Deep	3	68	71	2,191
Goldsmith, 5600'	131	7	138	7,463
Gaines Co.: Brown	4		4	47
Harris		2	2	75
Seminole		2	2	97
Irion Co.: Irion		6	6	
Pecos Co.: Donnelly		1	1	20
Winkler Co.: Emperor-Holt	15	2	17	398
Keystone-Holt	96	9	105	3,781
Monahans, N.-Glorieta		2	2	15
Yoakum Co.: Cobb		1	1	92
Total, Glorieta	348	245	593	18,469
Glorieta-Clear Fork				
Gaines Co.: Robertson	2	34	36	1,300
Howard-Mitchell Cos.: Iatan-E. Howard		442	442	3,478
Scurry Co.: Sharon Ridge, 2400'	8	117	125	527
Total, Glorieta-Clear Fork	10	593	603	5,305
Total, U. Perm. (Rustler thru Glorieta-Uppermost Clear Fork)	7,472	13,926	21,398	363,860
Clear Fork Lime				
Andrews Co.: Block 12	6	31	37	554
Dollarhide	15	1	16	684
Embar	10	1	11	244
Fullerton	532	58	590	24,284
Shafter Lake		2	2	50
Crane Co.: Jordan-Tubb	11	3	14	718
McKee-L. Clear Fork	1		1	56
Sand Hills-Tubb	223	95	318	6,041
Crockett Co.: Noelke	1		1	12
Dawson Co.: Spraberry, Deep	20		20	878
Ector Co.: Andector	83	13	96	10,248
Goldsmith	98	11	109	5,355
Lawson-Simpson	4	3	7	225
Penwell, 4500'	1		1	12
T.X.L.-U. Cl. Fk	51	30	81	3,153
Gaines Co.: Doss	1	41	42	908
Flanagan	7	6	13	730
Flanagan- Upper Clear Fork		1	1	38
Riley-Cl. Fork		1	1	8
Riley, N	3	17	20	887
Russell	6	37	43	1,377
Wasson 66	1	19	20	993
Wasson 72		5	5	98
Hale Co.: Anton-Irish		134	134	6,363
Hockley Co.: Smyer		54	54	1,408
Howard Co.: Iatan, N		25	25	217
Lubbock Co.: Cravens		1	1	5
Lee Harrison	2	8	10	209
Stennett		1	1	12
Midland Co.: Fasken		1	1	28
Tex Harvey	2	4	6	458
Mitchell Co.: Coleman Rch		36	36	295
Westbrook		157	157	1,132
Pecos Co.: Abell	1		1	7
Abell, 3800'	6	4	10	95
Scurry Co.: Diamond "M"		5	5	162
Upton Co.: Pembrook		1	1	29
Ward Co.: Monahans	33	3	36	693
Monahans-Perm	2		2	46
Winkler Co.: Keystone, S	7	5	12	426
Monahans, N	6		6	52
Total, Clear Fork Lime	1,133	814	1,947	69,190
Wichita Sand				
Andrews Co.: Martin-Wichita		2	2	40
Midland Co.: Midland, S		1	1	7
Total, Wichita Sand		3	3	47
Wichita Albany Sand				
Andrews Co.: Fullerton	3	1	4	134
Nelson		1	1	37
Union	2	32	34	976
Sterling Co.: Marvin		2	2	84
Total, Wichita Albany	5	36	41	1,231
Wolfcamp Lime				
Andrews Co.: Fullerton		1	1	5
Shafter Lake	14	15	29	1,229
Borden Co.: Gail, N	1		1	6
Gail, S		1	1	
Coke Co.: Blackwell		1	1	3
Crockett Co.: Clara Couch	2		2	83
Tippett	10		10	430
Ector Co.: T. X. L	1		1	
Hale Co.: Ariek	1	1	2	203
Kent Co.: Cogdell, 4900'	1		1	100
Pecos Co.: Abell-Ryerley	2		2	105
Upton Co.: Neal Ranch	1		1	62
Wilshire		1	1	18
Total, Wolfcamp	33	20	53	2,244
Total, L. Permian (Clear Fork, etc.)	1,171	873	2,044	72,712
Total, Permian	8,643	14,799	23,442	436,572
PENNSYLVANIAN PAYS				
Cisco Sand				
Ector Co.: Addis, Deep		1	1	10
Hale Co.: Petersburg		1	1	26
King Co.: Bateman Ranch	5	55	60	1,470
Runnels Co.: Geisecke		1	1	2
Jim Adams	5		5	381
Jimburt		3	3	52
Winters		1	1	3
Winters, N		12	12	377
Schleicher Co.: El Dorado	2		2	61
Total, Cisco Sand	12	74	86	2,382
Canyon Reef Lime				
Borden Co.: Good	21		21	2,331
Reinecke	8		8	933
Von Roeder	2	1	3	181
Gaines Co.: Doss	3	1	4	620
Howard Co.: Vealmoor	30	2	32	2,161
Vealmoor, E	1		1	194
Vealmoor, N	1		1	46
Kent Co.: Cogdell	35		35	2,380
Salt Creek	2		2	221
King Co.: "J. Y."		1	1	13
Scurry Co.: Diamond "M"	157	1	158	13,613
Kelly-Snyder	634	8	642	54,867
Schattel		1	1	2
Sharon Ridge	59		59	5,030
Snyder		109	109	521
Total, Canyon Reef Lime	952	124	1,077	83,113
Canyon Non-Reef				
Hale Co.: Ariek		4	4	119
Runnels Co.: Beddo	3	8	11	87
Florance	3	5	8	218
Palo Pinto Sand				
Coke Co.: Bronte	15	12	27	1,041
Runnels Co.: Miles, N		1	1	2
Total, Canyon Non-Reef	21	30	51	1,467
Total, Canyon	974	154	1,128	84,580
Strawn Sand				
Cochran Co.: Landon	2		2	233
Coke Co.: Ft. Chadbourne, W		1	1	147
Jameson	74	5	79	4,725
Lvway	3	2	5	162
Millican	13		13	919
Crockett Co.: Todd Deep (Crinoidal)	22	11	33	1,494
Ector Co.: Addis	2		2	105
Hale Co.: Lutrick		3	3	61
Irion Co.: Tankersley-Des Moines Sd		2	2	62
Kent Co.: Clairemont	1		1	140
King Co.: Ross Ranch	11	5	16	711
Pecos Co.: White & Baker	1		1	9
Runnels Co.: Aldridge-Garner Sd		4	4	57
Beddo-Dankworth		2	2	48
Ft. Chadbourne	25	6	31	1,201
Murray-Stevens	4	1	5	417
Winters-Strawn	6	1	7	319
Schleicher Co.: Baugh		1	1	20
Page	5	29	34	875
Scurry Co.: Early		1	1	38
Snyder, N	7		7	873
Sterling Co.: Iolanthe		1	1	5
Tom Green Co.: Pulliam		1	1	84
Susan Peak	44	9	53	2,060
Total, Strawn Sand	220	85	305	14,765
Bend Lime				
Concho Co.: Eden		1	1	2
Runnels Co.: Ballinger		2	2	2
Bend (Marble Falls) Sand				
Coke Co.: Arledge	2		2	13
San Benito		1	1	13
Total, Bend (Lime-Sand)	2	4	6	30
Unclassified Pennsylvanian				
Andrews Co.: Shafter Lake	1		1	27
Kimble Co.: Bolt	1	1	2	
Runnels Co.: Leonard	11	1	12	101
Lloyd	3		3	295
McMillan	1		1	6
Norton		1	1	9
Winters-Serratt		1	1	20
Terry Co.: Mound Lake		2	2	54
Tom Green Co.: Susan Peak, South	2		2	85
Total, Unclass. Penn	19	6	25	597
Total, Pennsylvanian	1,227	323	1,550	102,354
MISSISSIPPIAN PAYS				
Mississippian Lime				
Gaines Co.: Florey	1		1	13
Glasscock Co.: Garden City	1		1	35
Howard Co.: Gartner		1	1	2
Scurry Co.: Winfield		1	1	29
Total, Mississippian L	2	2	4	79
DEVONIAN PAYS				
Andrews Co.: Bedford	6	1	7	612
Block 12		1	1	9
Deep Rock	3	18	21	198
Dollarhide	93	2	95	5,134
Dollarhide, E	2		2	133
Fullerton, N-Devo	4		4	241
Fullerton, 8500'	62	13	75	4,179
Shafter Lake	19	40	59	4,152
Three-Bar	40	3	43	2,842
Cochran Co.: Landon-Devo	1		1	233
Crane Co.: Block 31-Devo	53	6	59	5,576
Cordona Lake	3		3	298
Crossett	19	1	20	422
Waddell-Devo. (Univ.)	2		2	298
Ector Co.: Goldsmith	5		5	290
Goldsmith, N	3	1	4	180
T. X. L	111	30	141	10,011
Gaines Co.: Flanagan	2		2	326
Jenkins		1	1	2
Jones Ranch	8		8	1,113
Robertson	1		1	
Russell, N		1	1	67
Garza Co.: Rocker "A"		3	3	69
Winkler Co.: Flying "W"	2		2	321
Keystone	66	17	83	3,501
Wheeler	45	7	52	2,880
Total, Devonian Pays	550	145	695	43,087
SILURIAN PAYS				
Fusselman Lime				
Andrews Co.: Dollarhide, E	1		1	30
Dollarhide	49	6	55	4,564
Crane Co.: C-Bar-Silurian		1	1	34
Ector Co.: Goldsmith, N-Sil	1	3	4	200
T. X. L.-Silurian	2	1	3	164
Pecos Co.: Abel-Silurian-Montoya	16		16	1,294
Heiner, N		1	1	7
Terry Co.: Corrigan	1		1	179
Ward Co.: Shipley-Silurian	2		2	16
Winkler Co.: Keystone-Silurian	38	10	48	2,516
Wheeler-Silurian	3	1	4	84
Total, Silurian	113	23	136	9,088
ORDOVICIAN PAYS				
McKee Sand				
Andrews Co.: Martin	7	12	19	945
Crane Co.: McKee		1	1	1
Ector Co.: Andector	2		2	86
Pecos Co.: Abell-Up. McKee	1		1	3
Abell, N.W	5		5	445
Girvin		1	1	
Total, McKee Sand	15	14	29	1,493



telescoping time and cost...

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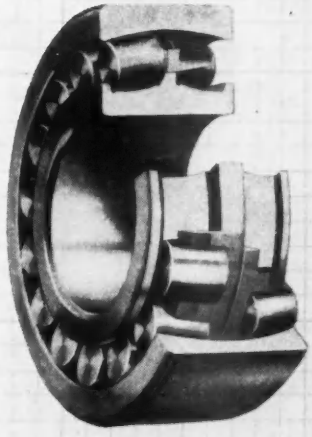
Franks Manufacturing Corporation portable rigs are designed to telescope time and cost in set-up and operation. This is accomplished with a telescoping mast and Torrington Spherical Roller Bearings in rotary table, draw works and other related equipment.

Spherical Roller Bearings are automatically self-aligning. They operate freely under deflection, and require no periodic alignment adjustments. Power requirements are less. Long service is secured with minimum maintenance.

Reduce the maintenance and operating costs of your product by specifying Torrington Spherical Roller Bearings. Our engineers will be glad to lend you a hand with design and application problems.



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Producing Wells and Daily Average Crude Production of Permian Basin Fields, by Producing Formations, Listed from Surface Downward

(CONTINUED)

County, Field	PRODUCING OIL WELLS Flowing	Art. Lift	Total	Bbls. Daily Prod.
Connell Sand				
Crane Co.: C-Bar	1	.....	1	36
Jordan	19	.....	19	1,156
Total, Connell Sand	20	.....	20	1,192
Waddell Sand				
Crane Co.: Sand Hills-Ord	13	12	25	579
Tucker	10	.....	10	434
Ector Co.: Andector	4	.....	4	156
Total, Waddell Sand	27	12	39	1,169
Total, Mid. Ord. or Simpson (McKee, Connell, Waddell)	62	26	88	3,854
Ellenburger Formation				
Andrews Co.: Bedford	6	1	7	1,023
Dollarhide	43	2	45	5,011
Embar	24	.....	24	2,239
Fullerton	3	2	5	582
Fullerton, S	13	.....	13	1,775
Martin	39	6	45	4,908
Nelson	.....	7	7	683
Shafter Lake	5	6	11	1,782
Borden Co.: Borden	1	.....	1	83
Coke Co.: Wendland	.....	1	1	5
Crane Co.: Block 31	16	.....	16	1,240
Jordan	28	1	29	1,949
Sand Hills, W	2	3	5	125
Waddell (Univ.)	14	.....	14	2,132
Crockett Co.: Midway Lane	20	13	33	1,821
Todd, Deep	59	6	65	5,235
Ector Co.: Goldsmith	3	.....	3	239
Penwell	1	1	2	96
T. X. L.	135	16	151	18,471
Yarborough & Allen	22	2	24	2,680
Gaines Co.: Flanagan	1	.....	1	115
Robertson	1	.....	1	94
Kent Co.: Polar	.....	2	2	30
Midland Co.: Sweetie Peck	1	.....	1	426
Warfield	1	.....	1	9
Mitchell Co.: Dockrey	1	1	2	43
Pecos Co.: Apco Warner	19	25	44	1,152
Heiner	2	.....	2	25
Pecos Valley-Ellen	3	.....	3	288
Wentz	.....	2	2	51
Reagan Co.: Barnhart	66	10	76	3,743
Scurry Co.: Dermott	.....	1	1	10
Hermleigh	.....	1	1	14
Snyder, N.	.....	1	1	.....
Sterling Co.: Spade	.....	1	1	18
Upton Co.: Benedum	1	2	3	20
McCamey	1	.....	1	73
Pegasus	10	.....	10	1,989
Ward Co.: Monahans	5	1	6	696
Winkler Co.: Kermit	3	.....	3	130
Keystone	139	9	148	15,055
Wheeler	35	2	37	3,919
Total, Ellenburger	723	125	848	79,979
Unclassified Ordovician (McKee, Waddell Ellenburger)				
Pecos Co.: Abell	61	13	74	1,879
Total, Ordovician	846	164	1,010	85,712

SOUTHEAST NEW MEXICO FIELDS

(Data as of January 1, 1950)

County, Field	PRODUCING OIL WELLS Flowing	Art. Lift	Total	Bbls. Daily Prod.
PERMIAN PAYS				
Yates Sand				
Eddy Co.: Barber	.....	8	8	91
Benson	.....	3	3	17
Black River	.....	3	3	13
Burton	.....	1	1	1
Lusk, W	.....	1	1	2
P. C. A.	.....	8	8	61
Russell	.....	46	46	268
Lea Co.: Baish	.....	3	3	24
Halfway	.....	4	4	88
Lusk	.....	4	4	32
Lynch	.....	9	9	304
Lynch, N	.....	1	1	13
San Simon	.....	2	2	20
Total, Yates Sand	.....	93	93	934
Yates-Seven Rivers Sands				
Eddy Co.: Aid	.....	4	4	5
Empire	.....	60	60	131
Getty	.....	8	8	187
Lea Co.: Cooper-Jal	34	71	105	2,179
Eaves	11	17	28	1,029
Rhodes	37	6	43	661
Wilson	23	22	45	1,627
Total, Yates-Seven Rivers	105	188	293	5,819
Seven Rivers Sand				
Eddy Co.: Fren	12	64	76	616
Turkey Track, 7 Rivers	3	.....	3	17
Lea Co.: Bowers	51	31	82	1,274
Eunice, S	89	12	101	1,569
Leonard	2	.....	2	16
Tonto	.....	1	1	4
Wilson, W	.....	6	6	191
Total, Seven Rivers	157	114	271	3,687
Total, All Above Yates and Seven Rivers	262	395	657	10,440
Yates-Queen Sands				
Eddy Co.: Shugart	1	10	11	120
Lea Co.: Pearsall	5	11	16	151
Total, Yates-Queen	6	21	27	271
Seven Rivers-Queen				
Lea Co.: Langlie Mattix	289	82	371	3,114
Queen Sand				
Eddy Co.: High Lonesome	.....	4	4	13
Loco Hills, Queen	.....	1	1	9
McMillan	1	.....	1	3
Shugart, N	.....	25	25	361
Turkey Track	5	6	11	41
Lea Co.: Caprock	1	126	127	2,256
Corbin	.....	1	1	5
Watkins	.....	2	2	11
Young	.....	7	7	138
Total, Queen Sand	7	172	179	2,837
Queen-Grayburg				
Lea Co.: Arrowhead	93	26	119	3,494
Hardy	17	16	33	182
Penrose-Skelly	125	179	304	1,389
Total, Queen-Grayburg	235	221	456	5,065
Grayburg Lime				
Eddy Co.: Grayburg-Keely	2	2	4	89
Leo	2	5	7	29
Loco Hills	44	168	212	1,840
Premier	13	37	50	348
Lea Co.: Maljamar, N	3	.....	3	54
Roberts	22	10	32	395
Watkins, Grayburg	.....	1	1	26
Total, Grayburg Lime	86	223	309	2,781
Grayburg-San Andres				
Eddy Co.: Anderson	13	18	31	156
Artesia	24	157	181	814
Dayton	2	9	11	17
Nichols	5	.....	5	110
Red Lake	28	81	109	732
Robinson	2	12	14	88
Square Lake	108	85	193	1,075
Lea Co.: Maljamar	186	74	260	5,570
Maljamar, E	.....	1	1	12
Maljamar, S	.....	1	1	10
Vacuum	171	225	396	12,169
Total, Grayburg-San Andres	539	663	1,202	20,753
Queen-Grayburg-San Andres				
Lea Co.: Eunice-Monument	739	202	941	29,880
San Andres Lime				
Eddy Co.: Atoka	.....	1	1	1
Daugherity	.....	2	2	5
Forest	16	.....	16	220
Grayburg-Jackson	185	144	329	4,796
Henshaw	.....	1	1	2
Lea Co.: Cross Roads-Slaughter	.....	1	1	2
Hobbs	205	51	256	10,242
Lovington	5	48	53	1,334
Lovington, W	13	44	57	2,022
Sawyer	1	1	2	19
Skaggs	3	1	4	54
Total, San Andres Lime	428	294	722	18,697
Total, Delaware Mt. (Yates thru San Andres)	2,591	2,273	4,864	93,567
Glorieta Lime				
Lea Co.: Garrett	.....	1	1	5
Paddock	75	26	101	4,281
Monument Paddock	4	.....	4	189
Total, Glorieta Lime	79	27	106	4,475
Total, Upper Permian (Yates thru Glorieta)	2,670	2,300	4,970	98,042
Yeso (=Clear Fork-Wichita)				
Lea Co.: Blinebry (Blinebry)	10	2	12	126
Drinkard (Drinkard)	332	24	356	18,434
Drinkard, N. (Clear Fork)	6	.....	6	72
Drinkard, S. (Drinkard)	.....	2	2	15
Elliott (Drinkard)	1	.....	1	19
Monument-Blinebry	2	.....	2	114
Weir (Dinkard)	1	.....	1	22
Total, Yeso	352	28	380	18,802
Abo-Hueco (=Wolfcamp)				
Lea Co.: Monument-Abo	3	.....	3	115
Total, Lower Permian (Yeso, Abo-Hueco)	355	28	383	18,917
Total, Permian	3,025	2,328	5,353	116,959
PENNSYLVANIA PAYS				
Lea Co.: Bagley-Penn	1	1	2	67
Bough (Permo-Penn)	2	.....	2	237
Cass (Strawn)	3	1	4	399
Crossroads Penn	.....	1	1	65
Total, Pennsylvanian	6	3	9	768
DEVONIAN PAYS				
Lea Co.: Bagley (Siluro/Devo	4	.....	4	326
Crossroads (Siluro/Devo)	4	.....	4	541
Denton	2	.....	2	242
Dublin	1	.....	1	8
Hightower	1	.....	1	199
House	.....	1	1	28
Knowles	3	.....	3	438
Total, Devonian	15	1	16	1,782
SILURIAN PAYS				
Lea Co.: McCormack (Fuselman)	2	.....	2	94
Total, Silurian	2	.....	2	94
ORDOVICIAN PAYS				
Montoya Lime				
Lea Co.: Cary	2	.....	2	135
Simpson Sand				
Lea Co.: Hare	15	1	16	953
Hare, S	1	2	3	140
Monument-McKee	1	.....	1	35
Teague (McKee)	6	1	7	635
Warren-McKee	2	.....	2	236
Total, Simpson Sand	25	4	29	1,999
Ellenburger Lime				
Lea Co.: Brunson	72	7	79	8,262
Fowler	1	.....	1	158
Total, Ellenburger	73	7	80	8,420
Total, Ordovician	100	11	111	10,554
Total, All Pays, S. E. New Mexico	3,148	2,343	5,491	130,157

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U. S. Patent 2,466,639 April 5, 1949

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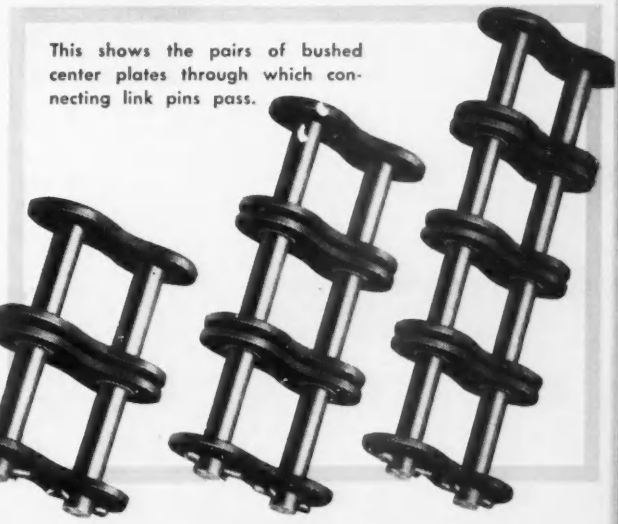
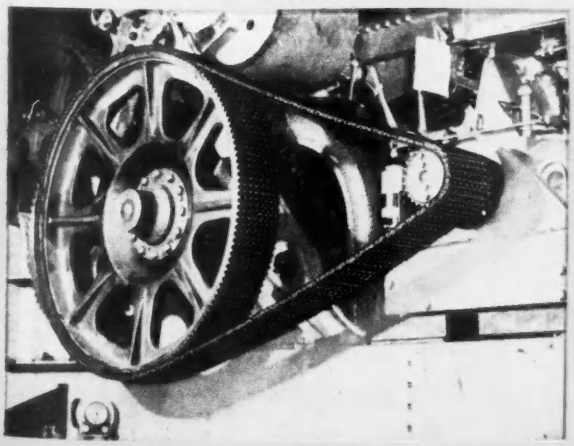
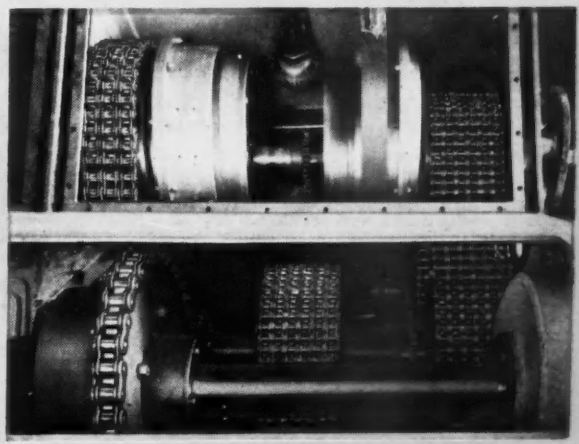
DIAMOND ROLLER CHAINS



This shows the pairs of bushed center plates through which connecting link pins pass.



For Heavy Duty jobs, multiple-strand Diamond Roller Chain with new Connecting Links add extra life and reduce costs.



Permian Basin Dominates U. S. Drilling Activity

By CECIL W. SMITH
Statistical Editor

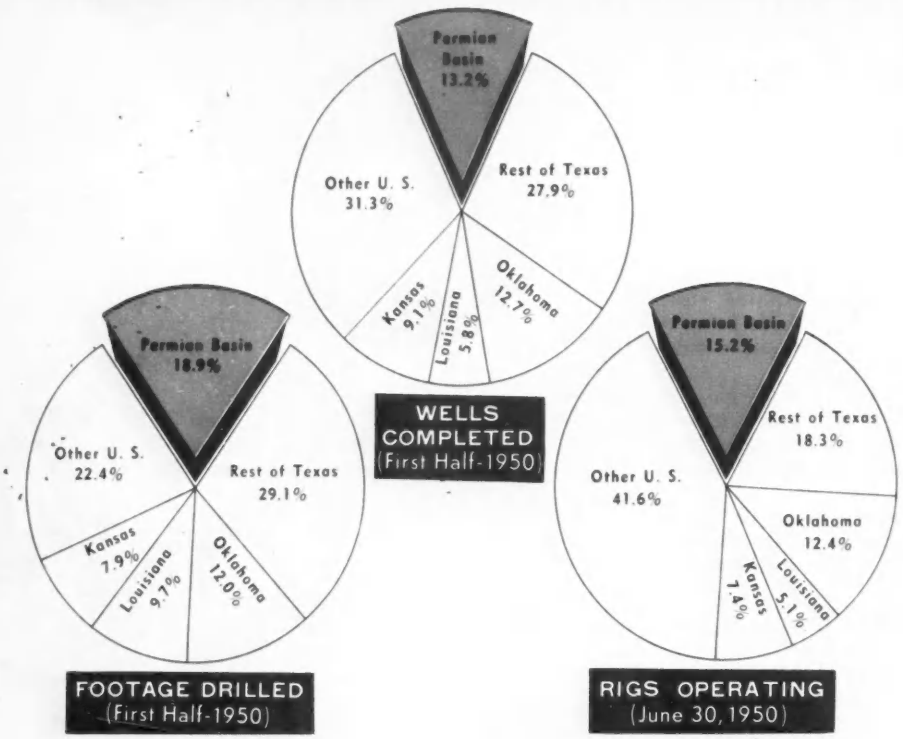
THE Permian Basin of West Texas (Districts 7-C and 8) and Southeast New Mexico holds a dominating position in the U. S. drilling picture. It is the most active drilling area in the world, outranking any state but Texas itself from the standpoint of well completions, footage drilled and rigs running. Leadership of the region is becoming increasingly larger, as its operations show a faster rate of growth than other sectors of the nation.

Well completions in the Permian Basin during the first half of 1950 totaled 46 percent more than in the same period of 1949, while the U. S. as a whole was recording an increase of only 8.5 percent. Consequently, this region accounted for 13.2 percent of all the new wells completed in the U. S. during the first six months of this year, in contrast with only 9.7 percent during the full year of 1949. The 2665 new wells completed in the first half of this year represented nearly half as many wells as were drilled in all the remainder of Texas and totaled 69 more than in Oklahoma, the second ranking most active state.

The area holds an even more important position in footage drilled, its wells having a greater average depth than most other regions. Footage drilled during the first six months of 1950 in West Texas-Southeast New Mexico rose 54 percent over the corresponding period of the previous year, while the U. S. as a whole was gaining but 10 percent. Therefore, the Permian Basin was responsible for 18.9 percent of all U. S. footage, although it contributed only 13.4 percent during the first half of 1949. The nearly 14 million feet of hole represented by new wells completed the first half of this year compared with slightly less than 9 million feet drilled in Oklahoma.

That the area is scheduled to continue to occupy this dominating position during the remainder of the year is indicated by the number of rigs operating currently. At the end of June, 1950, there were 722 rigs running in the Permian Basin as compared with 520 a year ago. The number of rigs operating in the area is practically the same as in all the remainder of Texas and 128 more than in Oklahoma. On June 30, the Permian Basin had 15.2 percent of all rigs running in the U. S., whereas at the same date in 1949 it had only 12.7 percent.

PERMIAN BASIN DRILLING OPERATIONS



	NEW WELLS COMPLETED		FOOTAGE DRILLED		Rigs Running On June 30	
	No.	% of U.S. Total	Amount	% of U.S. Total	No.	% of U.S. Total
TOTAL PERMIAN BASIN: (West Texas and Southeast New Mexico)						
First Half 1950	2665	13.2	13,991,418	18.9	722	15.2
First Half 1949	1826	9.8	9,076,056	13.4	....	....
Year 1949	3768	9.7	18,614,504	13.4	520	12.7
Year 1948	3886	9.8	18,210,688	13.3	663	13.0
Year 1947	2761	8.3	12,974,212	11.5	585	12.2
WEST TEXAS—(Districts 7-C and 8)						
First Half 1950	2379	11.8	12,691,403	17.1	619	13.0
First Half 1949	1562	8.4	7,899,288	11.7	....	....
Year 1949	3284	8.4	16,417,982	11.8	427	10.4
Year 1948	3317	8.4	15,764,298	11.5	554	10.9
Year 1947	2227	6.7	10,619,179	9.4	459	9.6
SOUTHEAST NEW MEXICO:						
First Half 1950	286	1.4	1,300,015	1.8	103	2.2
First Half 1949	264	1.4	1,176,768	1.7	....	....
Year 1949	484	1.3	2,196,522	1.6	93	2.3
Year 1948	569	1.4	2,446,390	1.8	109	2.1
Year 1947	534	1.6	2,355,033	2.1	126	2.6

Prospective *Pennsylvanian Reef and Non-Reef* Areas of West Texas

By

J. H. BARTLEY
Consulting Geologist

and

BERTE R. HAIGH
Supervising Geologist, University Lands

THE YEAR 1948 witnessed a buildup of the Pennsylvanian reef discoveries that initiated one of the hottest exploration campaigns in modern oil history. This article is a practical oil man's discussion of this Pennsylvanian campaign, its significance, and physical aspects of reef and non-reef structures. A geological map is included which contains heretofore unpublished information on trends and prospective areas for Pennsylvanian reef-type fields.

THE great oil boom developing in the Permian Basin oil province of West Texas has been brought about by the discovery of prolific production in reef reservoirs of Pennsylvanian age, principally the Canyon limestone. In the shadows of this tremendous rate of exploration for and development of reef production, the search for Ellenburger, Lower Ordovician, and the recently developed Spraberry sand, Lower Permian, production in the Midland Basin is not to be overlooked. As of July 19, there were 754 drilling wells in the Permian Basin area. During the period June 21-July 19 there were 349 producing completions, of which 43.5 percent were completed from the Pennsylvanian. Ninety-five percent of the completed Pennsylvanian producers were located in the Scurry reef trend play.

Development of Pennsylvanian production in West Texas has indicated 2 general types of reservoirs that should be definitely recognized when selecting prospective areas for exploratory drilling. These 2 types of reservoirs found in the West Texas area, for purposes of this discussion, are classified as "reef" and "non-reef." The reef type reservoir represents a limestone buildup which is anticlinal in appearance with the limestone disappearing laterally into shale, which, in many cases, defines the productive limits of the reservoir down to the established water table. Figure 1 shows that these reef-type reservoirs are developed in a belt along the Eastern Platform extending from Sutton County to King County, with a new trend, the "Scurry trend," extending from King County southwest to Borden County, swinging in a broad arc to the north and northwest through eastern Terry and Hockley counties, terminating at the south flank of the Matador Uplift. It should be noted that reefing does occur in isolated areas along the crest of the Matador Uplift, but, generally speaking, non-reef type structures will probably be more prevalent and similar in relief to that of the Arick field in southeastern Hale County.

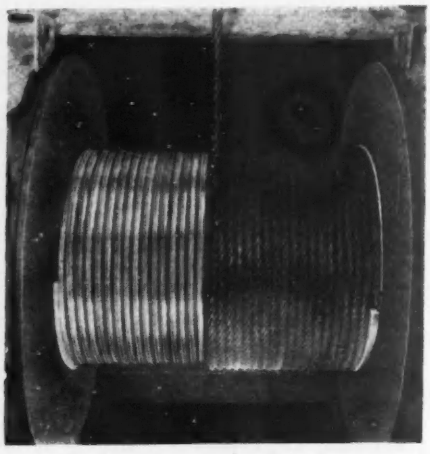
The non-reef type limestone reservoirs are classed as such because of the fact that their existence is due to primary structure. These reservoirs are similar, in many cases, to the reef type reservoirs with regard to character of the limestone and the faunal remains found therein, but do not represent a typical reef buildup.

On Figure 1 it should be noted that a few of these reservoirs are located on the Eastern Platform inboard of the reef type reservoir trend. The Scurry trend area has not evidenced a development of non-reef Pennsylvanian reservoirs; however, the general area comprising Lynn and Crosby counties could possibly be good "hunting grounds" for this type of reservoir. The Midland Basin, the east flank of the Central Basin Platform, the southeast flank of the North Basin Platform of Yoakum and Cochran counties, and the immediate north and south flanks of the Matador Uplift exhibit additional possibilities for further development of non-reef type reservoirs, in addition to the previously discussed crest of the Matador Uplift.

Throughout the Scurry trend area the Strawn section of the Pennsylvanian exhibits a biostromal type of reefing and is very widespread, whereas the Canyon section exhibits a biohermal type of reefing, it being in Canyon time that major reefing, as regards accumulation of petroleum, occurred in that area. Along the Eastern Platform reef trend the Strawn exhibits biohermal development, whereas the inboard non-reef reservoirs occur in Bend, Strawn and Canyon limestones, primarily Strawn, and can be generally classified as biostromal and associated with deeper seated features.

The Midland Basin and immediate adjacent areas, with isolated exceptions, (see Table 1), contain non-reef type structures and reservoirs which attribute their limestone thicknesses in accordance with their proximity to the eastern edge of the Central Basin Platform. There are areas along the eastern edge of the platform which have as much as 1475 feet of Pennsylvanian limestone section, it being questionable whether these areas exhibit reefing or represent additional limestone accumulation as a result of downwarping adjacent to the eastern edge of the Central Basin Platform during Pennsylvanian deposition. Most of the non-reef reservoirs in this area are Strawn age.

The importance of the development of this vast area is indicated by the size of the Scurry reef trend alone. Present data indicate that the portion of this reef trend extending from the Von Roeder field



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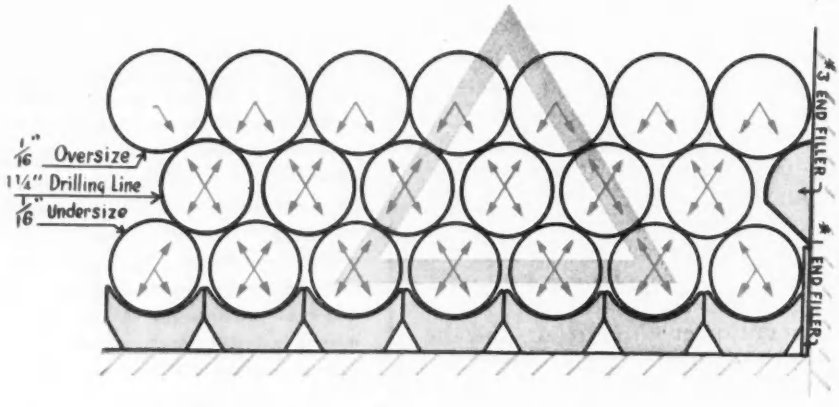
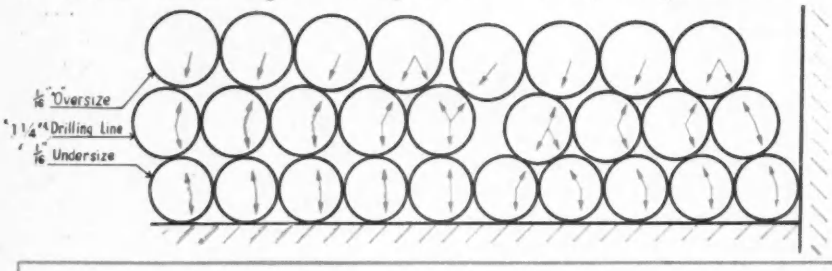


Flat Drum Spooling Crushes, Squeezes—Wastes—Drilling Line



Notice how disorderly tapered wire line spools on a flat drum. The result is squeezing and cutting-in as indicated by the red arrows. These wasteful and hazardous conditions can be corrected by grooving the drum with LeBus Grooving Installation.

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National 100—1¼" Grooving
HALL & STEWART DRILLING COMPANY
National 50—1⅛" Grooving
National 75—1⅛" Grooving
(2) National 100—1¼" Grooving
(2) U-15—1⅛" Grooving
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Oil Well 96—1¼" Grooving
HELMERICH & PAYNE (2)
Wilson Giant—1⅛" Grooving
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Bethlehem-450—1⅛" Grooving
LEE BROWN DRILLING COMPANY
National 100—1¼" Grooving
LIPSCOMB, R. C.
National 50—1⅛" Grooving
LOFFLAND BROTHERS COMPANY
National 125—1¼" Grooving
LOMAX BROS. DRILLING COMPANY (2)
Bethlehem-450—1⅛" Grooving
National 50—1⅛" Grooving
McALLISTER FUEL OIL
National 100—1¼" Grooving
McDANIEL & BEECHERL
Wilson Titan—1¼" Grooving
McQUEEN & CLEVENGER (2)
National 125—1¼" Grooving
McVAY-STAFFORD DRILLING COMPANY
National 125—1¼" Grooving
MAGNOLIA PETROLEUM COMPANY (2)
National 100—1¼" Grooving
National 125—1¼" Grooving
MOHAWK DRILLING COMPANY
Bethlehem-250—1⅛" Grooving
NELD & HOOD DRILLING
Wich-Tex R-5—1" Grooving
NOBLE DRILLING COMPANY
National 50—1⅛" Grooving
OHIO OIL COMPANY
National 100—1¼" Grooving
OLSON DRILLING COMPANY
National 125—1¼" Grooving
PARKER DRILLING COMPANY
Oil Well 96—1¼" Grooving
PHILLIPS PETROLEUM
National 100—1⅛" Grooving
POSTELLE, J. B. DRILLING COMPANY
National 100—1¼" Grooving
RALPH LOWE DRILLING COMPANY
National 75—1¼" Grooving
READING & BATES (2)
National 75—1⅛" Grooving
REPUBLIC SUPPLY COMPANY
Bethlehem Twister—1⅛" Grooving
ROBERTS & HAWKINS
Emsco J-750—1¼" Grooving
ROBERTS, S. B. DRILLING COMPANY
Emsco G-450—1⅛" Grooving
ROBINSON DRILLING COMPANY
U-15—1⅛" Grooving
ROWAN DRILLING COMPANY
National 100—1¼" Grooving
ROY GUFFY DRILLING COMPANY (8)
Unit Rig—1⅛" Grooving
SAWYER DRILLING COMPANY
Wilson Titan—1¼" Grooving
Wilson Titan—1⅛" Grooving
SHARP DRILLING COMPANY
Bethlehem-450—1¼" Grooving
SHELL OIL COMPANY
National 125—1¼" Grooving
SHOENFIELD, HUNTER & KITCH
Bethlehem-450—1⅛" Grooving
(2) National 50—1⅛" Grooving
Bethlehem-650—1⅛" Grooving
STANOLIND OIL & GAS COMPANY
National 100—1¼" Grooving
T & C DRILLING COMPANY
National 100—1¼" Grooving
TEX HARVEY DRILLING COMPANY (2)
U-30—1¼" Grooving
TEX.-MEX. DRILLING COMPANY
Emsco GA-500—1⅛" Grooving
TRINITY DRILLING COMPANY (4)
Emsco J-750—1⅛" Grooving
ZEPHYR DRILLING COMPANY (2)
Bethlehem-650—1¼" Grooving
Bethlehem-950—1¼" Grooving

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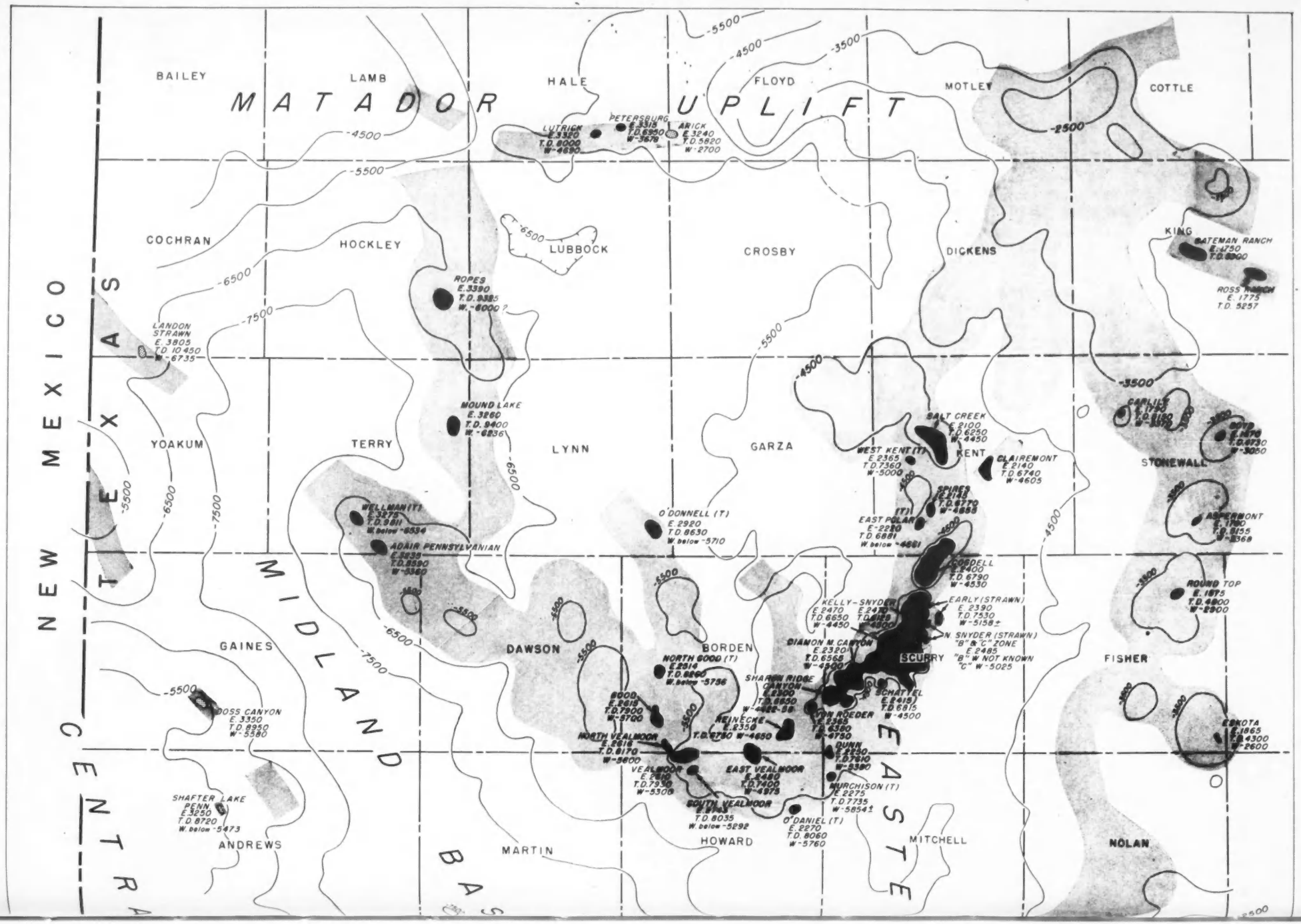
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DAWSON
BORDEN
SCURRY
FISHER
ANDREWS
MARTIN
HOWARD
MITCHELL
NOLAN
-5500
-4500
-3500
-2500
-6500
-7500
LUTRICK E.3320 T.D.8000 W-4630
PETERSBURG E.3315 T.D.6250 W-3670
ARICK E.3240 T.D.5920 W-2700
ROPES E.3390 T.D.9385 W.-6000?
LANDON STRAWN E.3805 T.D.10,450 W-6735
MOUND LAKE E.3260 T.D.9400 W.-6836
WELLMAN (T) E.3275 T.D.9811 W.below -6534
ADAIR PENNSYLVANIAN E.3639 T.D.8590 W-5360
O'DONNELL (T) E.2920 T.D.8630 W.below -5710
SALT CREEK E.2100 T.D.6250 W-4450
WEST KENT (T) E.2365 T.D.7360 W-5000
CLAIREMONT E.2140 T.D.6740 W-4605
SPIRES E.2174 T.D.6770 W-4655
EAST POLAR (T) E-2230 T.D.6881 W.below -4681
GOODELL E.2400 T.D.6790 W-4530
EARLY (STRAWN) E.2390 T.D.7550 W-5158±
N. SNYDER (STRAWN) "B" & "C" ZONE E.2485 "B" W NOT KNOWN "C" W-5025
KELLY-SNYDER E.2470 T.D.6650 W-4450
DIAMON M. CANYON E.2320 T.D.6568 W-4500
NORTH GOOD (T) E.2514 T.D.6860 W.below -5736
SHARON RIDGE CANYON E.2300 T.D.6530 W-4482-58
SCHATTEL E.2415 T.D.6815 W-4500
VON ROEDER E.2350 T.D.6350 W-4750
HEINECKE E.2350 T.D.6750 W-4650
GOOD E.2618 T.D.7900 W-5700
NORTH VEALMOOR E.2618 T.D.8170 W-5600
VEALMOOR E.2610 T.D.7950 W-5300
EAST VEALMOOR E.2480 T.D.7400 W-4978
SOUTH VEALMOOR E.2465 T.D.8035 W.below -5292
DUNN E.2330 T.D.7610 W-2390
MURCHISON (T) E.2275 T.D.7735 W-5854±
O'DANIEL (T) E.2270 T.D.8060 W-5760
SHAFTER LAKE PENN E.3250 T.D.8720 W.below -5473
BOSS CANYON E.3350 T.D.8950 W-5580
GATEMAN RANCH E.1750 T.D.6000
ROSS RANCH E.1775 T.D.5257
CARLILE E.1793 T.D.6152 W-5178
ROYD E.1870 T.D.6730 W-3060
ASPERMONT E.1780 T.D.6155 W-3368
ROUND TOP E.1875 T.D.4800 W-2900
DAKOTA E.1865 T.D.4300 W-2600

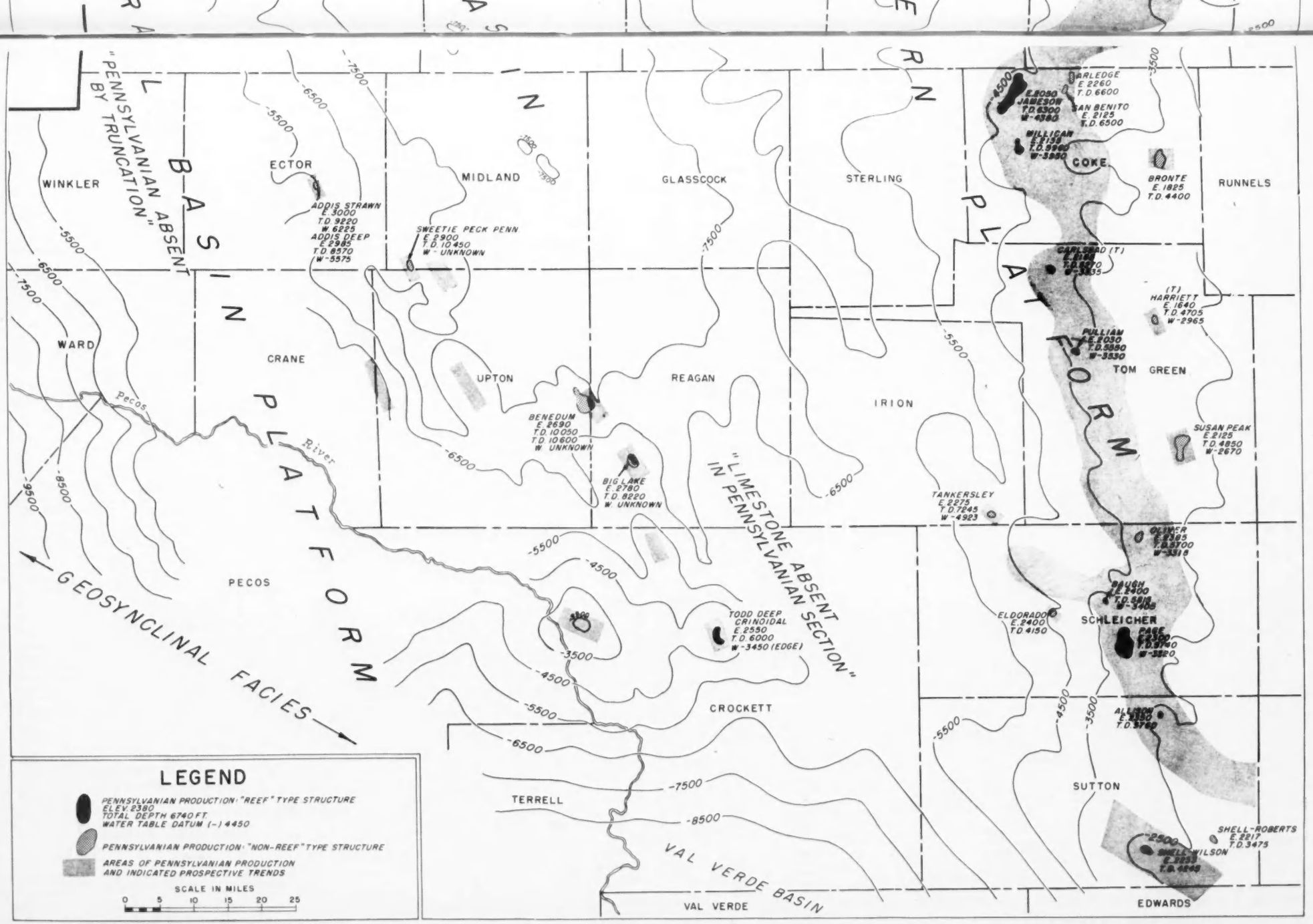


Figure 1. Regional Pennsylvanian subsurface structure map of West Texas Permian Basin Area. Contours on top of Pennsylvanian limestone. Contour interval: 1000 feet.

Pennsylvanian Producing Fields in West Texas Permian Basin

FIELD NAME	County	Discovery Date	Discovery Well	Producing Wells 7-1-50	Average Allowable	Average Surface Elevation	Average Total Depth	Average Water Table Datum	Division of Penn.	Type of Structure	Maximum Pay Thickness	Potential* Range BOPD	Average Gravity °API
Shafter Lake Pennsylvanian	Andrews	1-12-49	Sinclair No. 154-12 University	1	104	3247	8680	No Water		Non-Reef	122′	104	38.4
Good	Borden	4-10-49	Seaboard & Pan-American No. 1 T. J. Good	21	190	2615	7900	—5700	Canyon	Reef	484′	287-1348	42.5
North Good	Borden	(Not Comp.)	Ameche No. 1 W. P. Johnson	....	....	2514	8260	Below—5756	Canyon	Reef	30′+	.....	....
North Vealmoor	Borden	2-28-50	Seaboard No. 1 Porter-Hanks	1	180	2616	8170	—5600	Canyon	Reef	49′	218	43.6
Reinecke	Borden	2-16-50	G. R. Livermore No. 1 W. Reinecke	9	214	2350	6750	—4650	Canyon	Reef	236′	215-1368	46.4
Von Roeder	Borden	2-16-49	Amerada No. 1 N. C. Von Roeder‡	3	160	2365	6830(U) 7110(L)	—4500 —4754	Upper Canyon Middle Canyon	Reef Reef	48′ 20′	185- 624 185- 624	46.7(U) 38.8(L)
Landon Strawn	Cochran	7-11-45	Stanolind No. 1 J. M. Hall	2 2 oil	200 4	3805	10450	—6735	Strawn	Structure & Fringing Reef	140′	237- 321	40.0
Arledge	Coke	1-12-48	Sun Oil Co. No. 1 J. W. Arledge	1 Gas	21	2260	6600	Absent	Bend	Reef & Structure	10′	4- 21	45.0
Bronte	Coke	8- 9-48	Hickok & Reynolds No. 1 E. C. Rawlins	20	73	1825	4400	—2572	Canyon	Reef & Structure	56′	54- 383	46.0
Jameson	Coke	12-16-46	Sun Oil Co. No. 1 A. Jameson	72	111	2050	6300	—4380	Strawn	Reef	10′-280′	.....	46.0
Millican	Coke	11-12-48	Sun Oil Co. No. 1 R. W. Millican	10	120	2135	5960	—3950	Canyon	Reef	55′	160- 531	....
San Benito	Coke	6-30-48	Algord (Guiberson) No. 1 J. Lassiter	1	20	2125	6500	—4402	Bend	Reef & Structure	28′	20	46.0
Todd Deep Crinoidal	Crockett	4- 3-40	Conoco-Stanolind No. 2-B J. S. Todd	34	80	2550	6000	—3445	Strawn	Reef (Fringing)	130′	50-2016	41.5
Addis Deep	Ector	2-27-47	Stanolind No. 1 Ed. B. Kayser	1	113	2985	8570	—5575	Cisco	Structure & Fringing Reef	10′	160	33.0
Addis Strawn	Ector	7-22-48	Stanolind No. 1 E. F. Cowden	2	116	3000	9220	—6225	Strawn	Structure & Fringing Reef	20′	92- 204	39.0
Eskota (Reef)	Fisher	7-22-46	Skelly No. 1 A. Huddleston	23	50	1865	4300	—2585	Canyon	Reef	....	696- 826	40.9
Round Top (Reef)	Fisher	2-14-47	E. A. Hall No. 1 Terrell	111	73	1875	4800	—3000	Canyon	Reef	17(?)	307- 434	40.0
Doss Canyon	Gaines	7- 2-49	Ralph Lowe No. 1 Helen Cunningham	4	180	3370	8950	—5580	Canyon	Structure & Fringing Reef	100′	162- 303	47.0
Arick	Hale-Floyd	4- 4-48	Gen. American No. 1 A. F. Byrd	4	82	3240	5820	—2700	Cisco	Structure & Minor Reefing	115′	118- 406	41.0
Lutrick	Hale	2-22-48	Humble No. 1 J. A. Lutrick	3	1-101	3320	8000	—4690	Cisco	Reef	90′	1- 224	40.5
Petersburg	Hale	1- 5-47	Stanolind No. 1 E. L. Fisher	1	62	3315	6980	—3678(?)	Cisco	Reef	102′	(original 1342) on 11-1-49: 721	39.0
Ropes (T)	Hockley	5-21-50	Honolulu & Signal No. 1 Underwood	1	(?)	3390	9325	— 600(?)	Cisco	Reef	40′+	2236	42.0
South Vealmoor	Howard	5-27-50	Seaboard No. 1 Akin Simpson	1	180	2743	8035	Below—5292	Canyon	Reef	25′+	309	46.0
O'Daniel (T)	Howard	Not Comp.	Shell No. 1 O'Daniel	....	....	2270	8060	—5760 (?)	Canyon	Reef	.....	.....	....
Vealmoor	Howard-Borden	1- 5-48	Seaboard No. 1 B. Caldwell (now M. M. Jones-Fee)	34	120	2610	7910	—5300	Canyon	Reef	192′	186-1191	45.0
East Vealmoor	Howard-Borden	3-21-50	Barnsdall No. 1 Wilson	3	160	2480	7400	—4975	Canyon	Reef	46′†	178- 802	47.2
Tankersley	Irion	7-13-45	Shell No. 2 Tankersley Estate	2	15-30	2275	7245	—4923	Strawn	Structure & Some Reefing	14′	15- 96	45.0
Clairemont	Kent	4- 2-50	General Crude 79-1 Percy Jones	2	140	2140	6745	—4605	Strawn	Reef	50′	202- 207	38.7
Cogdell	Kent	12-20-49	Chapman-McFarlin No. 1 Cogdell	37	160	2400	6750	—4530	Canyon	Reef	427′	183-1006	41.7
East Polar (T)	Kent	6-26-50	Kewanee No. 1 Will Connell	1		2220	6881	Below—4661	Strawn	Reef	31′+	328	37.0
Salt Creek	Kent	3-29-59	Caroline Hunt Trust No. 1 J. W. Young	3	140	2100	6400	—4450	Canyon	Reef	504′	645- 825	39.5
Spires	Kent	5- 1-50	Barnsdall No. 1 Spires	1	160	2145	6770	—4655	Strawn	Reef	20′	400	42.0
West Kent (T)	Kent	5- 7-50	Sparton Oil Co. No. 1 Young	1	....	2365	7360	—5000	Strawn	Reef	14′	Pumped 51 BOPD Plus 50% Water	38.1
Bateman Ranch	King	10-14-43	Humble No. 1 Bateman	15	....	1750	Cisco 3665	—1915	Cisco	Non-Reef	30′	20- 210	....
Bateman Ranch				38	50	1750	Canyon 5150	—3455	Canyon	Reef	100′	30- 305	35
Bateman Ranch				1	....	1750	Strawn 5355	—3615	Strawn	Reef	20′	80- 150	....
Ross Ranch	King	1- 3-45	Ohio No. 1 W. R. Ross	17	80	1775	5257	—3535	Strawn	Structure primary reefing secondary	65′	60- 320	36.5
O'Donnell (T)	Lynn	5-20-50	Magnolia No. 1 Garza Land & Cattle Co.	1	....	2920	8630	Below—5710	Strawn	Reef	19′+	245	42.2
Sweetie Peck (Penn.)	Midland	5-12-50	Norwood Drlg. 3 Co. (Formerly L. T. Lohman) No. 1 Josie Fay Peck. Penn. Prod. indicated by Gen. American No. 1 Josie Peck (Ellen. Test)	1(7-15-50)	....	2900	10450	Unknown	Strawn	Non-Reef	110′	608	45.2
Dunn	Mitchell-Scurry	10-11-49	Std. Oil of Texas No. 1 G. F. Dunn	1	....	2250	7610	—5380	Lower Canyon	Reef	60′	(orig.)499	47.0
Murchison (T)	Mitchell	Not Comp.	J. W. Murchison No. 1 J. C. Womack	1	....	2272	7735	—5454±	Lower Canyon	Reef	.....	.....	....
Big Lake	Reagan	12-22-29	Big Lake Oil Co. No. 2-C University	2	....	2720	8220	Absent	Strawn	Fringing Reef	140′	25-1690	49-60°
Benedum	Reagan-Upton	9-20-48	F. Turner, Jr. & J. M. Hewgly No. 1 R. H. Barnett	4	135	2690	10050	Absent	Strawn-Bend	Non-Reef	200′ (Broken)	103- 747	58.5
Benedum	Reagan-Upton	2- 8-49	Plymouth No. 1 J. S. Elliott	4	125	2690	10600	Absent	Bend	Reef	88′	257- 563	53.5
Baug	Schliecher	5-28-49	Ohio Oil Co. No. 1 A. L. Baugh	1	15	2400	5815	—3405	Strawn	Reef	22′	50	39.8
El Dora	Schliecher	12-16-48	Skelly No. 1 M. L. Jackson	2(?)	50	2400	4150	—3405	Cisco	Non-Reef	30′	102- 270	33.5
Oliver	Schliecher	6-17-48	(Field indicated by Phillips No. 1 Whitten) Phillips Pet. Co. No. 1 W. J. Waddell	5-5-30 1	....	2385	5700	—3318	Strawn	Non-Reef	40′	35	36.5
Page	Schliecher	Gas 12-18-35 Oil 6-18-39	Bert Cooper et al No. 1 Page Lone Star Gas Co. No. 1-C-30 Humble-Page	34	80	2300	5450 5740	—3320	Strawn (or Lower Canyon)	Reef/some Structural Elements	165′	23-1120	43.0
Diamond-M Canyon	Scurry	12-19-48	Lion Oil Co. No. 2 McLaughlin	163	160	2380	6565	—4500	Canyon	Reef	332′	69-1108	43.0
Early (Strawn)	Scurry	4-14-49	Placid Oil Co. No. 1 W. W. Early	2	160	2390	7530	—5158±	Strawn	Reef	22′	107- 512	43.0
Kelly-Snyder	Scurry	(Kelly) 11- 5-48	Magnolia No. 1 Winston	687	160	2470	6650	—4450	Canyon	Reef	581′	69-2708	46.5
Kelly-Snyder	Scurry	(Snyder) 11-21-48	Standard of Texas 2 No. 1 Brown				6175	—4500	Canyon	Reef	764′		42.5
N. Snyder Strawn "B"	Scurry	10- 9-49	C. B. Hamill No. 4 L. S. Sentell	5	160	2485	7420	Unknown	Strawn	Reef	18′	232- 336	39.0
N. Snyder Strawn "C"	Scurry	2- 3-50	Sunray Oil Co. No. 1 L. S. Sentell	3	160	2487	7500	—5025	Strawn	Reef	12′	247- 439	45.1
Schattell	Scurry	7- 7-48	Sun Oil Co. No. 1 Emil Schattell	1	35	2415	6815	—4500	Canyon	Reef	60′	480	42.8

Sharon Ridge Canyon	Scurry	2-20-49	Humble No. 1 R. Bishop	67	160	2300	6650	—4422	Canyon	Reef	323′	132–1020	43.0
Aspermont	Stone Wall	2-24-42	Shell No. 2 Rutherford	1	Plugged	1785	5155	—3365	Strawn	Reef	20′	54	37.0
Boyd	Stone Wall	4- 1-39	Forest No. 1 Boyd	2	...	1670	4730	—3050	Canyon	Reef	30′	187	39.0
Carlile	Stone Wall	7-13-38	Stone Wall Oil Co. No. 1 Carlile	1	43	1790	5150	—3372	Canyon	Reef	12′	361	40.0
Allison	Sutton	12-27-42	S. B. Roberts No. 2 Geo. Allison	2 (Gas)	Shut-in no Outlet	2350	3760	Not Known	Canyon	Reef	65′	3-6 MM-CF per day 148 MCF	...
Shell-Roberts	Sutton	4-25-49	Shell No. 1 S. B. Roberts	1 (Gas)	Shut-in no Outlet	2217	3475	Not Known	Strawn	Non-Reef	63′	per day 9.2 MMCF per day	...
Shell-Wilson	Sutton	5-27-46	Shell No. 1 Duke Wilson	1 (Gas)	Shut-in no Outlet	2233	4245	Not Known	Strawn	Reef	50′	150- 233	43.0
Mound Lake	Terry	11- 6-48	Seaboard No. 1 E. M. Hinson	2	137	3260	9400	—6236	Cisco	Reef	50′		43.0
Wellman (T)	Terry	7-12-50	Anderson-Pritchard No. 1 A. C. Bevers	....	....	3275	9911	Below—6534	Lower Cisco	Reef	103′ +	2280	42.5
Adair Penn (T)	Terry	Not Comp.	Amerada No. 1 N. W. Willard	....	....	3235	8590	—5360	Cisco	Reef	112′	...	43.0
Pulliam	Tom Green	10-31-49	Sun Oil Co. No. 1 M. E. Pulliam	2	....	2030	5550	—3530	Strawn	Reef	32′	47- 210	37.9
Susan Peak	Tom Green	12-16-48	Plymouth No. 1-A J. W. Green	52	73	2125	4150	—2670	Canyon (Reef)	Structure & Minor Reef	20′	65- 427	38.5
							4850		Strawn (Str)		70′	65- 427	
Carlsbad (T)	Tom Green	Not Comp	Bridwell et al No. 1 J. F. Kennemer	1 (Dist.)	....	2185	5720	—3535	Strawn	Reef	70′	...	...
Harriett (T)	Tom Green	Not Comp.	Shell No. 1 J. W. Johnson	....	....	1840	4705	—2805	Strawn	Structure & Minor Reef	30′	...	...

(T) Field name is tentative.
* Initial production as reported to R. R. Commission, in many cases representing amount of oil produced during 4 or 6 hour tests.
† Geo. Brown No. 1 L. Branon, completed well, indicates 1½ mile south extension and 170′ additional pay.
‡ This well was completed from middle Canyon 7100–7110 and indicated Upper Canyon production on DST. Amerada No. 1 Weathers opened production from Upper Canyon on 4-22-50.

in southeastern Borden County to the northern productive limits of the Cogdell field in southern Kent County could be one continuous reservoir having a water table datum variation of only approximately 30 feet. This immense province of possible contiguous production is 35 miles long and ranges between 2 and 6 miles wide, with 114 square miles of present proven productive area.

The first Pennsylvanian reef production in West Texas was discovered at the Big Lake field (southwest Reagan County) in December, 1929, and the development of Pennsylvanian production in the Permian Basin progressed slowly. Six years later in December, 1935, the Page field, central southeast Schleicher County, was indicated by the discovery of gas, with oil being developed in June, 1939. The Carlile field, northwestern Stonewall County, discovered in July, 1938, and the Boyd field, central Stonewall County, opened in April, 1939, were not important reef discoveries as regards future oil reserves, and it is doubtful that the reef development in this area was recognized as having any relationship to that in Schleicher or Reagan counties. In April, 1940, the Todd Deep Crinoidal field, north central Crockett County, was discovered and stimulated exploration over most of western Crockett County. The next reef discovery of major significance was the Jameson field, northwestern Coke County, in December, 1946. At this time the importance of reef-type reservoirs was recognized and research in quest of areas indicating limestone buildup was begun by a few oil companies and individuals. Recovery factors as evidenced by production from the older reef reservoirs were an added incentive. In January, 1948, the Vealmoor field, northwestern Howard County, was discovered and initiated a renewed search for additional Pennsylvanian reef type reservoirs. In November, 1948, the North Snyder field, the "granddaddy" of the reef reservoirs of West Texas, was discovered, indicating a gross oil column 764 feet thick. Following the North Snyder strike, new discoveries of Pennsylvanian reef-type reservoirs have been developed continuously to the present time as shown in Table 1.

The present daily per well allowable for all of the reef and non-reef type fields is shown on the table. The average daily allowables shown are for July, 1950. The fields having an average higher per well allowable are of the reef type located in the Scurry trend, and in most cases production occurs in the Canyon section of the Pennsylvanian. This fact alone indicates the importance of Canyon reef-type reservoirs. Effective August 1, a special order fixing the allowable crude production in all of the fields and districts in Texas was issued, which returned all the fields and districts to allowables based on their most efficient rate of production. This was an increase over their July allowable schedules. The daily allowables of the reef type reservoirs in the Scurry area were retained in the new order but have their producing days increased from 21 to 25 per month. This exception is the result of reported insufficient pipe line facilities serving that area.

The gravities of oil produced from Pennsylvanian reservoirs in the West Texas area range between 35° and 60° API, and the oil is classified as sweet. It is apparent that these gravities vary according to the type of reservoir, the age of the Pennsylvanian section, and the local province in which the reservoir is located. The Bend, Strawn and Canyon oils along the Eastern Platform have an average gravity of 44. In the King County area the Pennsylvanian oils have an average of 36 gravity and are produced principally from the Strawn and Canyon sections. This average gravity is subnormal for oils of Pennsylvanian age in the West Texas area.

The Strawn oils of the Scurry trend average 39 and are usually brownish in color; however, the Strawn oil being produced from the North Snyder Strawn "C" field averages 45 and is light green in color, similar to the Canyon oils. The Upper Canyon and Cisco oils in the Scurry trend average 43, whereas the Middle Canyon oils in this trend, i. e., Salt Creek and the discovery well of the Von Roeder field, average 39. The gravities of oils produced from reservoirs in the Midland Basin area and along the eastern edge of the Central Basin Platform average 44. The oil produced from the Addis Deep (Cisco) is 33 gravity, which is unusually low for Pennsylvanian oils; likewise, the oil produced from the Addis Strawn field, which averages 39 gravity, is low in relation to that produced by other Strawn reservoirs in the Midland Basin area. The Benedum and Big Lake fields

in turn produce oils which are abnormally high in gravity, "distillate" type, for Strawn oils in this area. In the Matador Uplift area the oil averages 40 gravity, being Cisco in age.

In summation, it is apparent that there is a definite relationship between the gravity of the oil produced and the type of reservoir, reef or non-reef. The reef-type reservoirs produce higher gravity oils than do the non-reef type. Of course, there are unusual exceptions which in most cases are explained by a diagnostic study of those fields producing oil which is abnormally high or low in relation to other reservoirs of a similar type. In this respect the Bateman Ranch and Ross Ranch fields of King County produce oils which are abnormally low in gravity although they are regionally classified as reef-type. There is some evidence indicating that in addition to reefing, structure building as a result of a buried granite knob influenced the accumulation in these reservoirs, and further detailed studies of these two fields may indicate that they should be classified as non-reef type.

Oil-water contacts in the Pennsylvanian reservoirs represent varying conditions. The Todd Deep Crinoidal field exhibits an "edge" oil-water contact, the edge water being on the west flank of the field which is a result of the reef being a fringing type, occurring on the west slope of the Todd field structure. Three Pennsylvanian reservoirs, Big Lake, Benedum and Arledge, have no apparent water table present. The remaining reservoirs exhibit a normal oil-water contact with the exception of a few of the more recent reef discoveries which were not drilled deep enough to determine an oil-water contact.

Tracing the Scurry reef trend from the Salt Creek field in Kent County to the Ropes field in Hockley County, the oil-water contact subsea "datums" in the reservoirs along this trend become progressively lower relative to the top of the Pennsylvanian limestone reef. The oil-water contact will change for each individual limestone build-up, varying within the reservoir, being controlled by the amount of buildup in the reef.

It is found that the crest of a reef reservoir will have a fairly consistent oil-water contact; however, progressively down the slope of the reef, the oil-water contact will tend to rise due to the "ragged edge" of the reef, especially when the top of the reef datum approaches a range of 80 to 100 feet above the oil-water contact indicated under the crest of the reef structure. Usually the oil-water contact will rise higher on the eastern slope of a reef buildup than it will on the western slope, relative to the oil-water contact indicated under the crest. An example of this condition exists in the Diamond "M" Canyon field of Scurry County. The Lion Oil Company McLaughlin 45, (C SE NW 197, Blk. 97, H&TC Sur.), which is near the crest of that reef structure, topped the reef at a subsea datum of (—) 4236 and established the oil-water contact at a subsea datum of (—) 4502. The same operators' Zelma 1 (C SE SE 147, Blk. 25, H&TC Sur.), on the west slope of the reef structure, topped the reef at a subsea datum of (—) 4352 and encountered water at a subsea datum of (—) 4475. On the east slope of this reef structure, water has been encountered in conjunction with the top of the reef at a subsea datum of (—) 4436.

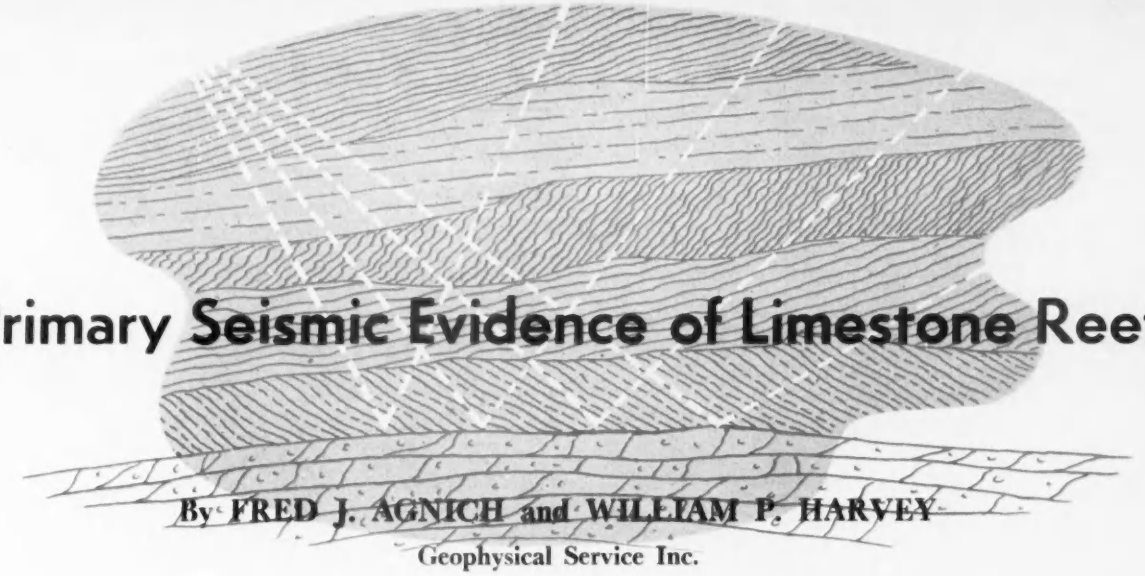
The possibilities for additional Pennsylvanian oil reservoirs in the West Texas Permian Basin area are unlimited. There are numerous reef prospects along the Eastern Platform reef trend, extending northward into Cottle County and along the Scurry reef trend which swings in a broad arc southwestward from King County to northern Howard County and thence northwestward into eastern Hockley County (Figure 1). Other reef trends could possibly develop as additional exploration in the area progresses, but the present available subsurface data does not indicate this occurrence unless the Crosby-Lynn County region reveals an area of reefing. At the present writing, the Crosby-Lynn County region is practically void of sufficient geological subsurface data to classify it properly, but indications are that no area of reefing similar to the Scurry Reef trend should be anticipated.

In the areas of non-reef Pennsylvanian reservoirs the possibilities are numerous and varied, due to the fact that these reservoirs can be developed by simple structural movements, complicated by faulting, truncation, and non-deposition. This condition should offer good prospects for additional reservoirs along the north and south flanks of the Matador Uplift, the eastern flank of the Central Basin Platform, and throughout the Midland Basin. It is quite possible that this type of structural condition could exist along the western flank of the Central Basin Platform and out into the Delaware Basin adjacent to the platform.

About the Authors

BERTE R. HAIGH has been supervising geologist for Texas University Lands since 1937, and has been active in West Texas geology for the past 24 years. He received his B.S. degree in mining engineering from the Texas College of Mines and Metallurgy (now Texas Western College) in 1925, and the following year joined Dixie Oil Company, Inc., at San Angelo as geologist. In 1928 he returned to Texas College of Mines and Metallurgy as assistant professor of geology and engineering, where he remained until 1934 when he joined Texas University Lands in San Angelo. His headquarters are now in Midland.

J. H. BARTLEY has been following Pennsylvanian reef development since 1946, and Permian Basin geology since 1938. He received his B.S. in petroleum geology from the University of Texas in 1937, and will shortly finish his master's thesis on "The Simpson Group of West Texas and Southeast New Mexico." He joined University Lands in August, 1938, as geologist in Midland. In 1942, he joined the U. S. Navy, seeing active duty in Europe and the Pacific. On his release April 1, 1946, as a full lieutenant, Bartley returned to University Lands as senior geologist and remained until September 1, 1950, when he entered consulting practice.



Primary Seismic Evidence of Limestone Reefs

By FRED J. AGNICH and WILLIAM P. HARVEY
Geophysical Service Inc.

IN THE approximately 2 years that the petroleum industry has concentrated its exploration efforts in the Permian Basin, primarily towards the discovery of limestone reef production, several articles and papers have been published anent the application of geophysical methods to this problem. It was realized early[1] that, of the methods at the disposal of the exploration industry, the greatest reliance would have to be placed upon the reflection seismograph. The experience obtained has served to emphasize this point and, while the gravimeter is being used to some extent, the brunt of the exploration effort is being carried by the reflection seismograph.

In the initial analysis of the problems entailed by reef exploration, it was felt that the seismologist would have to rely mainly upon secondary evidence and that, except in certain areas such as along the Red River Uplift, little success would be obtained in working with reflections coming from the reef surface itself. This secondary evidence has been discussed in detail by several authors[2] and consists mainly of shallow structural effects over a reef body caused by differential compaction between the reef and off-reef materials and of false anomalies on beds below the reef caused by a velocity discontinuity between the overlying reef and off-reef materials.

Alcock[3] considers the differential compaction effect to be the more reliable of these 2 secondary characteristics and, certainly, such a condition is almost always present over a reef build-up of any great magnitude. However, a study of the case histories of the Abilene Geological Society Symposium[4] shows that the amount of compaction of the sediments any appreciable distance above a reef is often so small in magnitude that it is beyond the resolving power of the reflection seismograph, particularly in some of the more difficult record areas in which a large part of the present exploration effort is being conducted. In most of the cases listed in this symposium, the compaction closure mapped on a formation above the reef is less than 50 feet. Such small closures are difficult to detect by reconnaissance survey and would require such detailed control as to be prohibitively expensive in the exploration of large areas. The main drawback of such shallow closures is that even after they have been delineated by detailed work they do not establish by themselves the presence of a reef at greater depth inasmuch as they may be caused by local tectonic folding.

The men in charge of exploration departments can hardly be criticized if they are loath to recommend the drilling of a deep test on a small, shallow closure, which by itself may have but little commercial significance, unless they have additional evidence upon which to help postulate the presence of a reef.

Reef Velocities

A false "velocity" high will be mapped beneath a reef only when the velocity of the reef material is higher than the velocity of the surrounding sediments. In most cases, reef velocities are higher than those of the surrounding materials and the reverse may occur rarely but in many cases the differential between the two is so small as to make insignificant the resulting velocity anomaly. In all cases the velocity anomaly will show considerably less relief than the reef surface itself, and it is difficult to determine whether or not an actual tectonic feature may be present instead. The drawback which exists with this type of evidence, when taken by itself, is similar to that of the previously mentioned shallow compactional folding, in that it does not offer a definite enough indication as to the presence of a reef.

Thus, the secondary effects obtained by reflection shooting are of value mainly as contributory evidence when used in connection with the primary reef effects discussed below, and are limited in use when employed in areas which thus far have no reef production.

As a consequence of the realization of the shortcomings of these secondary reef evidences, seismologists are more and more trying to use primary evidences to secure a more positive identification of reef build-ups. Such primary evidences include all the steep seismic events which are unconformable with the regional subsurface interpretation at or near the suspected reef depth. In strictly wildcat areas, abnormally steep dips anywhere in the geologic section should be investigated.

Although a velocity interface of sufficient magnitude is present at a reef boundary, the reflections obtained are generally poor in character probably because of the usually irregular shape and surface of the reef itself. However, portions of the reef surface may be sufficiently regular to provide an adequate reflecting surface for at least a few spreads. In addition, reflections with abnormally steep dips often come from sediments lying so close to the reef surface itself that they reliably follow the reef topography. These reflections are generally of much better quality and may, at

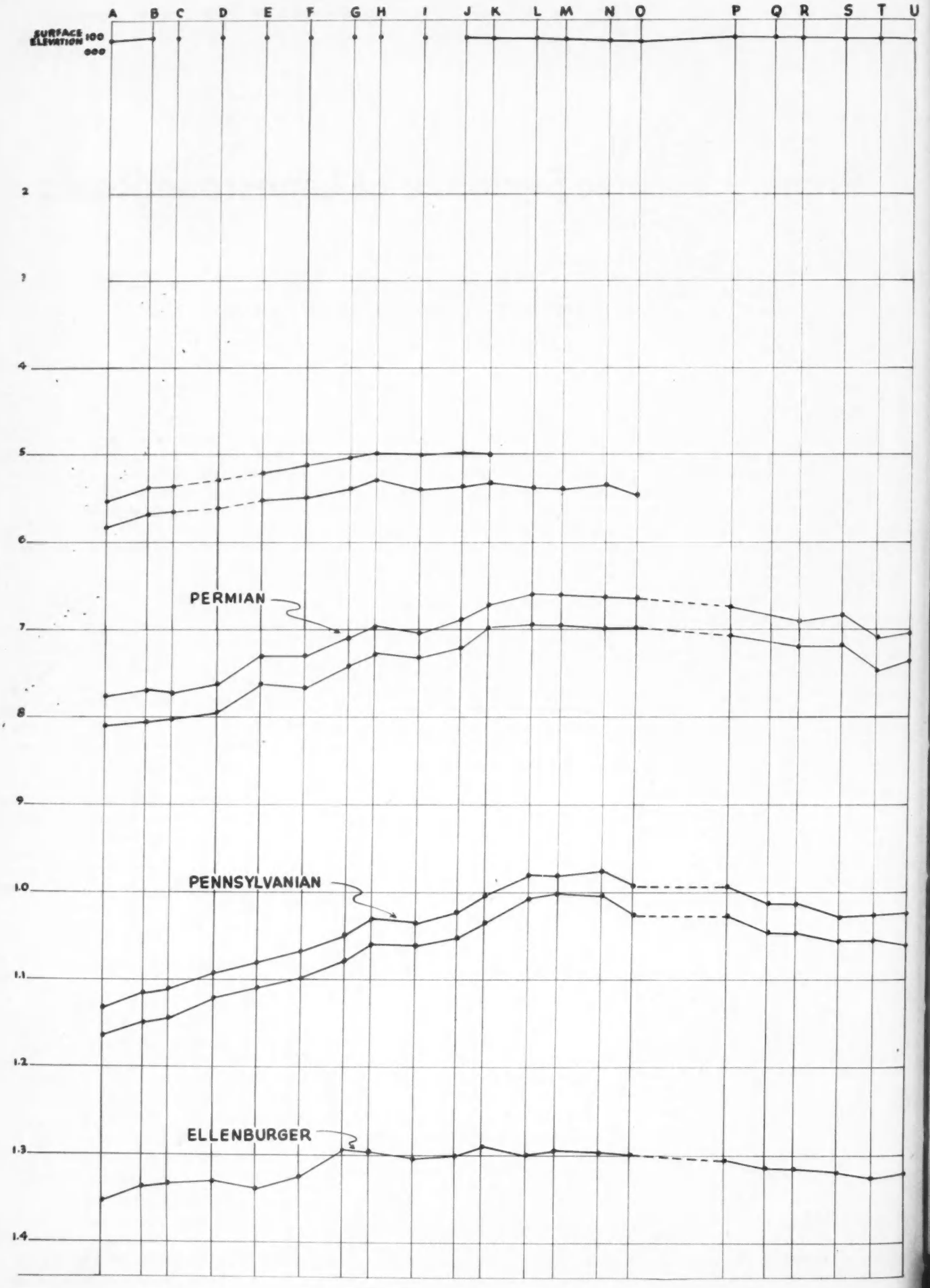
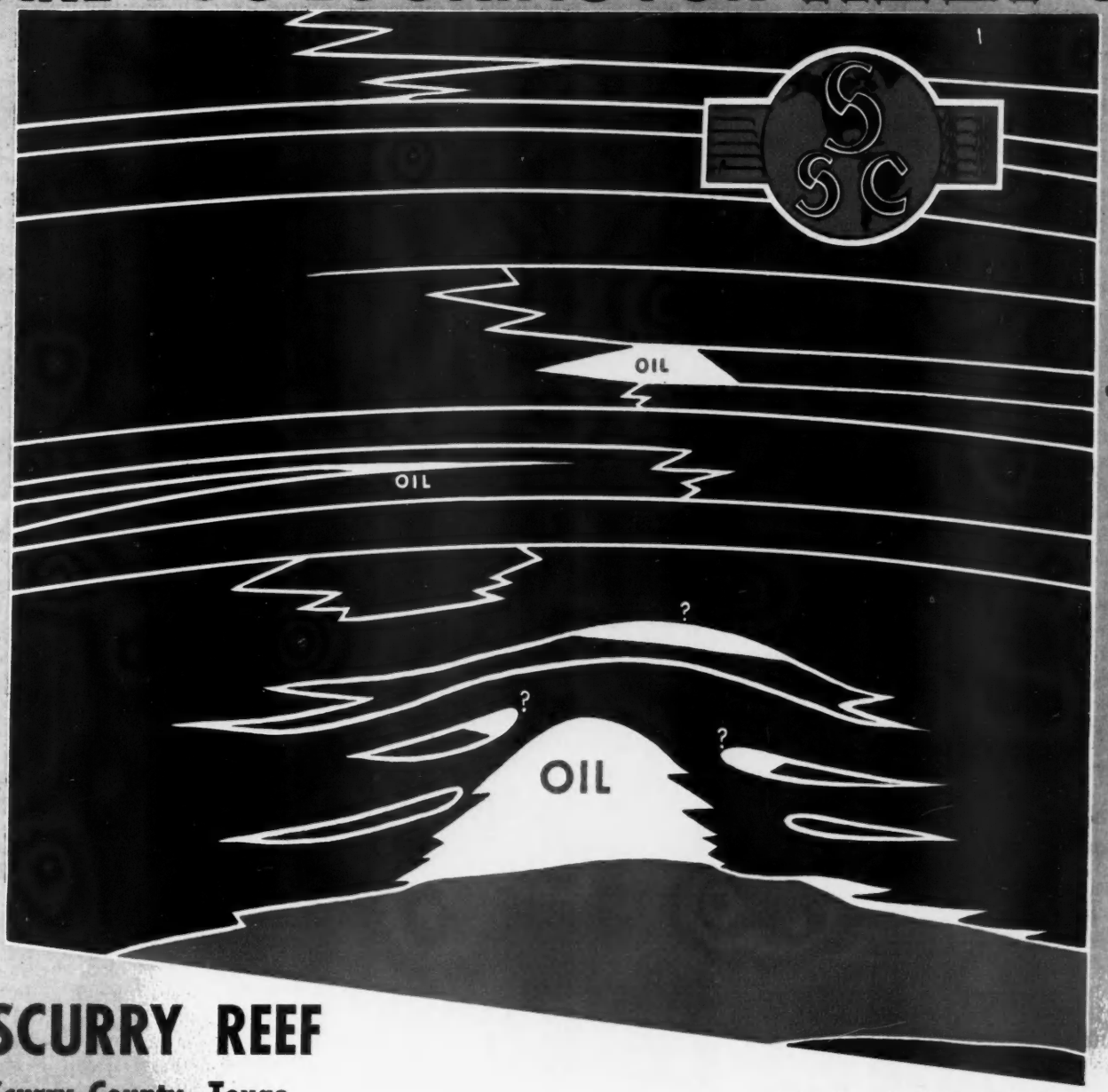


FIGURE 1. Seismic cross-section of suspected reef.

ARE YOU LOOKING FOR REEFS?



SCURRY REEF

Scurry County, Texas

The above sketch is an idealized conception of the general geologic features.

This is a fairly broad, elongated oil-bearing reef (possibly of the barrier type) of Lower Pennsylvanian (Canyon) age. Oil accumulation in the main reef is unusually rich. Some oil also occurs in up-dip fingers near the base of the reef, below the water level of the main accumulation.

The top of the reef is quite irregular with as much as 500 feet of relief between offset wells.

Additional oil accumulations have already been found in draped beds above the main reef, and others may be found. Structural interpretation of draping in the upper formations is complicated because of the persistence of lateral facies transition zones through a substantial part of the critical vertical section.

SSC Recommends the Following Approach for Seismic Reef Exploration

No. 1. COMPLETE GEOLOGICAL AND GEOPHYSICAL CO-ORDINATION

Abnormal subsurface conditions may be expected in the vicinity of organic reefs. For this reason, complete geological and geophysical co-ordination, both in the field and in the home offices, is required to resolve properly the seismic data. SSC emphasizes that such a policy is one of the PRIME REQUISITES of a successful reef exploration program.

(This is one of a series)

Seismograph Service Corporation

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times, be the best event present on the seismic record. Also, although these reflections may not be continuous over the entire area they may be adequate to accurately delineate one edge and approximately determine the axis of the reef. In some areas it is possible to correlate the reef reflections with enough assurance to make possible the construction of a map showing the reef topography with sufficient accuracy to guide developmental drilling.

The main criterion for differentiating steep reef events from equally steep regional, tectonic, or velocity anomaly dips is an observed divergence between the suspected reef reflections and reflections from deeper in the geologic section. Figure 1 shows a seismic cross-section of a suspected reef in West Texas which has not as yet been tested by the drill. From this cross-section the pronounced divergence between the Pennsylvanian and Ellenburger reflections is readily apparent. Figure 2, a seismogram from a relatively difficult record area in West Texas, shows pronounced divergence between the Permian-Pennsylvanian and Ellenburger horizons in the short horizontal distance across just one profile.

This divergence would not be present if this steep dip were associated with regional structure, a tectonic feature, or an extreme velocity anomaly. The presence of abnormally steep dips in the Pennsylvanian is not by itself a positive indication of bioherm development in that section. It has been amply demonstrated by Daly[5] and others that the vertical velocity in the Permian section is subject to extreme variations in relatively short horizontal distances. Since the Ellenburger horizon in the cross-section fails to show dip of anywhere near the magnitude of the Pennsylvanian, it can be assumed that this structure has not been introduced by an extreme velocity change in the Permian, unless a velocity change of equal magnitude but of almost opposite effect was present between the Pennsylvanian and Ellenburger horizons. While it might be conceivable that such a canceling effect could be present on any one line, this is not likely, and other lines shot in the area confirming the relative Pennsylvanian and Ellenburger structure as shown here demonstrated that such velocity cancelation was not present.

It is the belief of some geophysicists that many reflections apparently coming from the section below the Pennsylvanian are, in reality, merely multiples of some shallower bed and, therefore, are of no value in determining deep structure. The seismologist, consequently, should check deep (Ellenburger) reflections by all usual methods[6] to be as certain as possible that they are not multiples.

The utilization of primary reef evidence from seismic records requires some change in the operating procedure of the seismic field party. The observer of such a crew should be a man of unusual ability who watches each record carefully for reflections coming from the suspected reef depth and keeps his eyes open for events which diverge from the other reflections on the record. Particular attention must be paid to record quality because the unusual seismic event which often is the tip-off to reef topography may exist for only 2 or 3 profiles on any one line. If the record quality is impaired by faulty instruments, improper selection of filter bands, poor geophone placement, or improper hole depth or charge size, this evidence may be lost and an important lead missed.

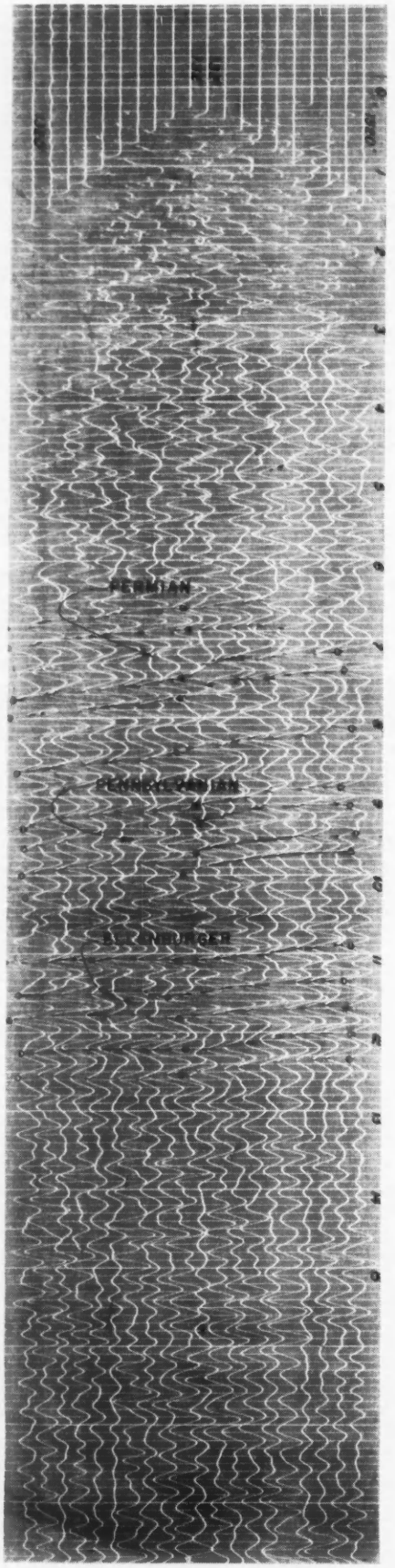

FIGURE 2.
A West Texas seismogram showing divergence.

The party chief's or seismologist's job in picking and interpreting records takes on new significance. Many reef tip-offs no doubt are already contained in the files of oil operators' old seismic prospects. The steep, unusual event which lasted for only a profile or two was often not mapped because it could not be carried for more than a short distance. If it aroused the seismologist's interest, he may have called his fellow worker's attention to this event and then passed it off as something interesting but unexplainable and of no commercial interest.

The reef seismologist cannot ignore the abnormally steep dips which appear on only a few records. They must be picked and plotted on the cross-section no matter how unreasonable they may look at the moment. Particular care in picking these reflections must be paid to avoid aligning them consciously or subconsciously with better deep or shallow reflections. The suspected reef dips should be picked as independently of the rest of the record as possible and character correlations, if made, checked at that depth only. In checking a new area for possible reefs, a thorough study of the seismograms and of the vertical cross-sections sohuld be made to determine if there are any seismic events which diverge from deeper reflections. If this divergence can be reliably established from the seismograms, the possibility of reef topography beneath the area is greatly substantiated.

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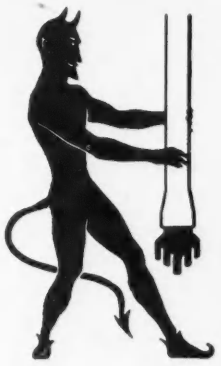

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West Texas
IMPORTANT PLAYS
New Mexico

Current West Texas-Southeast New Mexico oil activity is made up of a number of different plays, any one of which would be considered significant if located in some other region. Collectively, these are what make the Permian Basin area the present "hot spot" of the oil industry. The more outstanding of these various important plays are described on this and the following six editorial pages.

FAMED REEF PLAY

Greatly Expanded By Recent New Discoveries

WEST Texas' reef development, which got off to a spectacular start in 1949, already has mushroomed out from Scurry County into widely scattered areas in a number of adjoining counties. From all appearances the end still is not in sight. While the reef play heretofore has been to the north and southwest of Kelly-Snyder field in Scurry County, recent reef discoveries included distance stepouts some 50 miles northwest in Terry and Hockley counties. Recent discovery of the Salt Creek field, Kent County, is also significant because it represents another expansion of considerable magnitude for the north trend. Further enlargement of the Borden-Scurry-Kent trend is indicated, and at the same time much interest unquestionably will be devoted to the possibilities of the northwest trend indicated by the Terry and Hockley discoveries. The over-all play appears to be taking shape of an arc.

In the short period of time it has been under development, this reef play has had a terrific impact on both drilling and producing operations. In less than 18 months, more than 1000 wells have been completed and approximately 200 rigs are operating at present. Opinions differ as to the amount of reserves which may be represented, but certainly they constitute the most important discoveries since finding the East Texas field in 1930; and new discoveries make it necessary to constantly revise upward any current reserve estimates.

Hundreds of locations still remain to be drilled (between 250 and 300 in one field alone), so together with recent important extensions and new discoveries, some of major proportions, the reef area will be the scene of much activity for a long time to come. As nothing has occurred to date to lessen the prospects for the region, only a shortage of casing and other tubular goods as a result of a war-time steel shortage seems likely to create a slump in drilling operations at any immediate date.

The performance of the Scurry reef production has caused a complete re-examination of the Pennsylvanian section in logs of old failures in all adjacent areas and these studies may bring interesting results. In conducting the reef exploratory campaign, numerous shows and indications of commercial production have been found in other zones, both above and below the sought-after reef zones. Prolific Cisco reef has been found in the Cogdell area. Strawn has shown for commercial production (enabling some dual completions) in isolated areas down the east flank of the original North Snyder field. Clear Fork pumping production has been found in the Diamond M field. The discovery well of the Von Roeder field produces from a Basal Canyon pay zone. Good Cisco or Wolfcamp has been found in East Vealmoor, and in scattered areas Mississippian and Ellenburger zones have been found to be productive.

Peak drilling activity already has passed in some sectors of Scurry County, notably in the Kelly-Snyder, Diamond M and Sharon Ridge Canyon fields. Bulk of present drilling in these fields is confined to inside and edge locations, with some of the latter proving additional minor bulges along the flanks. However, slackening off in activity in these older areas is being offset by steady to increasing activity in newer discoveries.

The Cogdell area, discovered in the last week of December, 1949, is now undergoing a rapid expansion on both its northern and southern ends. At the south end, wide stepouts virtually prove that the area between Cogdell and the Kelly-Snyder field will be productive. Upwards of 250 to 300 locations appear to have been proved in this intervening region. This would make a continuous producing area from southern Sharon Ridge Canyon field northward through Diamond M, Kelly-Snyder to northern Cogdell of some 35 miles long.

In addition to the regular Canyon reef producing horizons, the Cogdell sectors shows promise of yielding substantial production from the Cisco reef. On the basis of a few wells already completed in the Cisco and drill stem tests made on the way down to the Canyon, this upper formation appears likely to embrace a substantial area. Meanwhile, some recent potentials on Canyon reef wells have ranged up to 1000 and 2000 barrels daily through ¾-inch cokes.

One of the most recent and perhaps a major addition to the reef play is the Salt Creek field, lying north of Cogdell in central Kent County. Although discovered in April, 1950, 10 completions have proved an area about 3 miles long by about 2 miles wide. At this writing its possibilities remain wide open, with no outlying failures within 2½ miles. There are 12 rigs running in the field. Discovery of this most northeasterly

BENNY ROBINSON, Party Chief on Crew No. 5, started digging shot holes for Independent right after he got out of Louisiana Tech 15 years ago. He has progressed through practically every job on a geophysical crew, having worked as shooter, recorder, surveyor, and computer, before being made a party chief. Such long and thorough experience is typical of the seasoned men who head all Independent Exploration crews, where the average experience of party chiefs is 15 years in seismograph field work.

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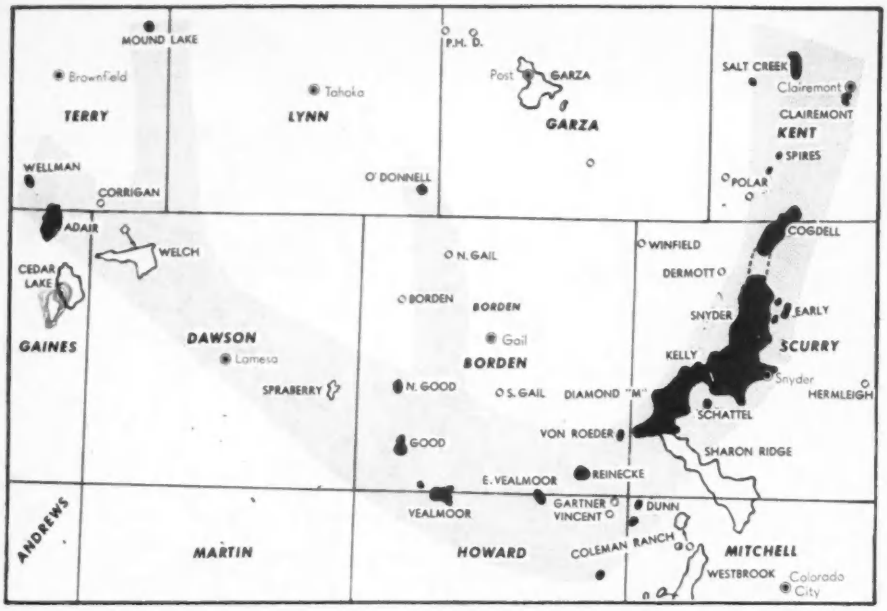


New discoveries have greatly enlarged West Texas' famed reef play. Reef-type structures are shown in solid black on above map, while other type producing structures are merely outlined. The shaded area indicates probable trend of development following recent discoveries far to the west and a northeast extension with discovery of Salt Creek field.

field undoubtedly will cause much additional exploration farther to the north, with prospects indicating that Dickens, Motley and Cottle counties will be brought into the play.

There is a marked increase in activity in and around several new areas discovered to the southwest of the Scurry fields in southern Borden County. The 3-well Von Roeder field, discovered in December, 1949, and located about 3 miles southwest of the Sharon Ridge Canyon sector, seems slated to receive additional development. This appeared evident when an outpost 2 miles southwest of the original discovery recently found Canyon reef production. Of special significance in this field is the fact that the discovery well produces from the Basal Canyon below the normal Canyon water level. Later completions, however, have been made in the Upper Canyon without testing this lower section. Other reef production has been found south of Von Roeder in northwest Mitchell County.

The Reinecke field, approximately 6 miles west and slightly south of Von Roeder, still is enjoying considerable activity, although it appears to have been defined by dry holes on the northeast, east and south sides. While comparatively small in area, this field is outstanding for its big potentials (up to 4000-5000 barrels daily) from a comparatively thin reef zone.

The East Vealmoor field, discovered in March, 1950, is a 2-pay 5-well pool which shows excellent promise of becoming of major importance. A recent completion opened the O'Daniel pool, approximately 6 miles southeast. Good Cisco (or Wolfcamp) reef also is productive in at least 1 well in the vicinity of the East Vealmoor discovery.

Several additional new reef producing fields have been opened farther west of East Vealmoor, and 1 field has been opened north and slightly east in southeastern Lynn County. Then there are the brand new major stepouts in Terry and Hockley counties, which lie 50 miles northwest.

Production Data: Structures are a series of reef highs. Tops of reef vary in different fields, ranging from around 6100-6200 feet at Salt Creek; 6300 feet in Cogdell; 6900 at Von Roeder; 6800-6900 at Reinecke; to 7435 in East Vealmoor. Pay thickness also varies, from 100 up to as high as 500 feet of broken pay section. In a typical section, 60 to 80 percent of the interval may be productive. Average total depths vary from 6500-7500 feet, depending upon area. Wells, spaced on 40 acre patterns, generally flow upon completion. Maximum base allowable is 160 barrels per well per day. Crude is sweet, with gravity ranging from 37 to 47 degrees. Some of the highest gravities are found in the Borden field. Gas-oil ratios generally are less than 2000 to 1. Pipe line outlets include Magnolia, Gulf, Texas-New Mexico, Paso-Tex, Sun and Pan-American.

Drilling Data: Either 9⅝- or 8⅝-inch casing is set through salt found at 1500-2000 feet and cemented with 600-1200 sacks to at least top of salt; 7 or 5½-inch oil string set at top of pay, from 30 to 100 feet into pay, or to total depth, depending upon company policy, and cemented with 250 to 600 sacks of cement. Acid often is used in completing, particularly on edge wells where porosity is lower.

The most common drill pipe is 4½-inch, with some 3½-inch used. Approximately 15 to 18 6¾- to 8-inch drill collars are used in 12¼-inch hole and about 18 5¼ to 6¼-inch collars in the smaller lower hole. Bit consumption ranges from 4 to 7 12½-inch and from 26 to 30 8¾-inch in the lower hole. Typical rotary speed is 55 to 65 rpm. Weight on bit is 30,000 pounds in 6¾-inch hole and 50,000 pounds in 8¾-inch hole.

Commercial muds are sometimes required in salt beds found in upper part of hole, but generally clear water is used to within few hundred to 1000 feet of top of pay. No general circulation problems exist, though some lost circulation is encountered near surface at Salt Creek and in pay zone in Borden County wells. Mud costs range from $1000 to $5000, the higher figures being in Borden County.

Eighty percent of the rigs used are of jackknife type, and the remainder are medium depth standard rigs. Practically all rigs are power type, using natural gas, butane-propane, and some diesel oil. Most rigs use single mud pump; some use 2, particularly in Borden County area. One or two blowout preventers. Average rigging up time from 24 to 36 hours when skiddding jackknife rig, and up to several days when rig is torn down and re-erected. Average completion time 30 to 36 days.

Drilling water usually available from local water wells. Some areas experience difficulty obtaining water, particularly in Kent County.

Total cost of completing wells varies from $65,000 to $70,000. Prevailing footage rates are $5.25 to $5.75 depending on what is furnished. Day rates vary from $550 to $650.

Snyder is principal supply and machine shop center. Road conditions are medium to poor, although U. S. Highway 180 traverses area. Surface terrain is level to gentle rolling and in some places (like Cogdell and Salt Creek) badly cut up with arroyos.

Living conditions for crews is fair to poor, with Snyder, the largest town, still offering scarce accommodations, although the situation is improving. Limited accommodations are available in smaller towns.

TEX-HARVEY FIELD

Opens Large New Producing Zone

West Texas IMPORTANT PLAYS New Mexico

THE Tex-Harvey field, 16 miles southeast of Midland, is the largest of several recently discovered fields to produce from the Spraberry formation, a comparatively new oil producing zone for the Permian Basin. Since finding first Spraberry production in Spraberry field in January, 1949, this lower Permian formation has been proved productive at 5 scattered points along a 100-mile north-south trend extending from the Pembrook field on the south to the North Gail field in Borden County on the north. The area between these known Spraberry producing fields is thought to offer good opportunities for finding similar low relief structures and/or stratigraphic trap conditions. Little apparent structure or relief can be expected, as Tex-Harvey has shown for only little more than 100 feet of relief.

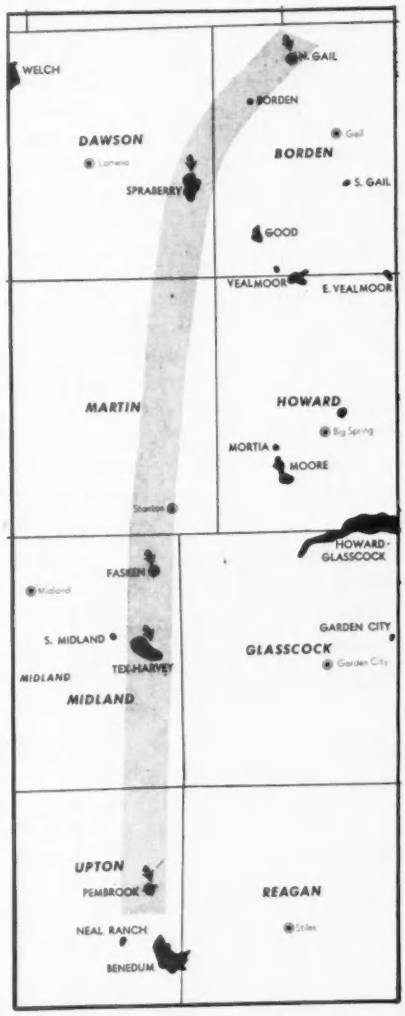
Production Data: Tex-Harvey, found in March, 1949, is still too new to make an accurate evaluation of its potentialities, but it is expected that more than 15,000 acres will be productive and estimates of yields range from 10,000 to 20,000 barrels per acre.

The Spraberry sand, topped at about 7000 and bottomed around 8000 feet, has shown for over 300 feet of pay in 2 sections separated by a shale break. To date there have been 12 completions, some in upper section only and others in both sections. Typical wells have a potential of 250 barrels and receive an allowable of 121 barrels daily. Some wells flow, others pump. Field is on 40-acre spacing. Casing pressures range up to 900 pounds; tubing flowing pressure is 60-70 psi. Crude is 40.2 gravity, sweet. Oil production currently is trucked out, but plans are nearing completion for laying 2 pipe line outlets.

The discovery well, Tex-Harvey Oil Company's B. W. Floyd 1-16, was dry in the Ellenburger but but had shows of oil and gas in the Devonian; tested 35 barrels daily on drill stem test in the Pennsylvanian; and had a show in the San Andres. It was plugged back to the Spraberry and completed as a pumper making 135 barrels of oil daily with 13 percent water.

Principal leaseholders are: Tex-Harvey Oil Company; Phillips; Magnolia; Ted Weiner; Harry B. Lake; John Barnett; Comanche Corporation; Glendale Oil; General American and Frankel Brothers.

Drilling Data: Currently there are 12 rigs running, with activity to increase as competitive drilling among operators now is getting underway and will continue unabated for sometime. Wildcatting activity is brisk, with stepouts of from 1 to 3 miles in all directions common.



Arrows point to fields which are producing from the Spraberry sand, a comparatively new source of oil for West Texas. The shaded area shows the 100-mile long north-south trend thought to offer good possibilities for finding additional similar production.

Typical casing program calls for 200 feet of 13⅜-inch set with 200 sacks of cement; 4400 to 4500 feet of 8⅝- or 9⅝-inch set with 500 sacks; with 5½-inch (sometimes 7-inch) oil string hung from about 4100 to top of pay around 7050 feet set with 500 sacks, and open hole from there to bottom. Drill pipe string usually is 4½-inch with 18 6-inch drill collars. About 12 12¼-inch and 18 8¾-inch bits are required.

Mud control is not critical; clear water is used to about 6900 feet, gel type mud to 7000 feet, then oil base mud to drill into pay. Some lost circulation is encountered around 4500 feet, but is corrected with lost circulation materials. Occasionally have to drill through a thief sand without returns. Wells generally complete by circulating out oil, then are shot with 800 quarts of explosives for upper zone and 1500-1600 quarts if completing in 2 zones.

Average rigging up time about 3 days, with average completion time 45 days. Power rigs, principally gas and diesel driven, with jackknife or conventional medium-size derricks used; with 2 medium-size mud pumps and 1 shale shaker. Blowout preventers not normally required. Excavated pits and ditches usually used. Drilling water obtained from shallow water wells. Field gas available, but other fuels trucked to field.

Prevailing footage rates about $6 per foot; daily rates from $550 without drill pipe to $650 with drill pipe. Fully equipped well costs about $90,000.

Nearest supply and machine shop centers are Midland, 16 miles northwest, or Odessa, 38 miles northwest. State highway passes near field. Field roads are good, being sandy with some caliche. Surface terrain is rolling, barren or rocky hills. Living accommodations for crews generally good in Midland and Odessa.

IMPORTANT PLAYS

West Texas New Mexico

NEW DEEP DISCOVERIES

Renew Pre-Permian Search in Northwest Sector

A renewed search for pre-Permian production in the extreme northwest sector of the Permian Basin has been precipitated by the discovery during the past year of the Bagley, Hightower and Denton fields in northern Lea County, New Mexico. Since the discovery of these 3 important new high gravity fields considerable attention has been revived in this northwest section, with prospecting working out to the westerly limits of the Permian Basin.

Production Data: Siluro-Devonian production at Bagley was discovered in July, 1949, with Pennsylvanian production in August, 1949. The Hightower field, 3 miles south, began producing from the Devonian in August, 1949, and gas condensate was found in Permo-Pennsylvanian in January, 1950. The Denton field, 10 miles northeast of Lovington, began producing from the Devonian in October, 1949; from the Mississippian in December, 1949; and from the Wolfcamp (Permian) in February, 1950. All are anticlinal structures.

Although pay zones are relatively thin, unusually large potentials are obtained. To date Bagley has 7 Siluro-Devonian producers and 2 in Pennsylvanian; Hightower has 2 each in Devonian and Pennsylvanian. The Denton field has 3 Wolfcamp, 1 Mississippian and 2 Devonian wells. All wells are flowing. Except for a structurally low failure to the east of Bagley which did not go to Devonian, fields are undefined. Pennsylvanian production will cover a larger area than Devonian. Twin locations ultimately will result. Depending upon structural position, Siluro-Devonian at Bagley is topped from 10,650 to 10,980 feet with from 15 to as high as 172 feet of exposed pay; Bagley Pennsylvanian is topped at 9000 feet with average of 40 feet of perforated interval open to production. Hightower Devonian is topped at 10,148 to 10,170 feet with average of 16 feet of exposed pay; while Permo-Pennsylvanian in this field is topped at from 8585 to 8660 feet, with average of 26 feet of exposed pay. Denton Devonian is topped at 11,250 feet with about 100 feet of exposed pay; Mississippian is found at 11,267 feet with 34 feet of pay; while the Wolfcamp is topped around 9395 feet and pay sections open to production varies from 57 feet to 230 feet.

Top allowables at Bagley are 211 barrels daily for Siluro-Devonian and 170 barrels for Pennsylvanian; while at Hightower the Permo-Pennsylvanian is shut in and Devonian wells are allowed 211 barrels per day. Current allowables at Denton are: Wolfcamp, 178 barrels; Mississippian, marginal; Devonian, 256 barrels daily. Crude is sweet. Spacing is 80 acres at Bagley and Hightower; 40 acres at Denton.

Drilling Data: Four rigs are running at Bagley and 2 at Hightower. Average completion time in Bagley 4 to 4½ months; Hightower 3 to 3½ months. At Denton, Wolfcamp wells required 4 months and Devonian from 5 to 7 months. Heavy rigs, generally powered with gas or butane-propane fuels, required.

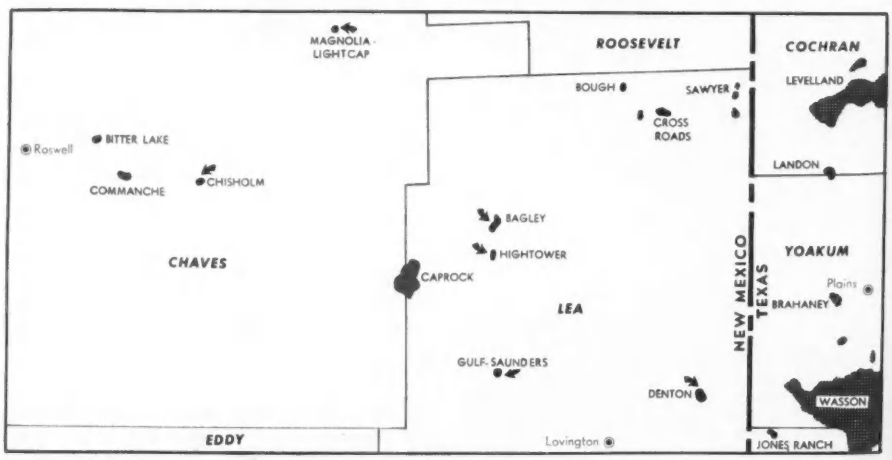
Typical Bagley-Hightower program is to set 13⅜-inch to 300 feet with 300 sacks of cement; 8⅝-inch through salt to 4000 feet with 1500 sacks of cement; and 5½-inch to or into pay zone. Wells are either cased to bottom and perforated, or have open hole left opposite pay. Acidizing in Siluro-Devonian or Devonian calls for approximately 500 gallons, while approximately 2000 gallons are used in Pennsylvanian wells.

At Denton, 13⅜-inch casing is set at 350 feet with 350 to 500 sacks of cement; 9⅝-inch is landed at 4700 feet with 1000 to 2000 sacks; and 5½- or 7-inch cemented with 1000 to 1700 sacks at top of pay or to total depth. Mississippian and Wolfcamp wells are acidized, up to 2000 gallons used in latter.

Drill pipe string usually 4½-inch with 20 drill collars. Bit consumption average 125 for 10,000 to 11,000-foot wells. Coring usually with diamond bit. Rotary speeds vary from 40 to 100 rpm, and weight on bit from 25,000 to 50,000 pounds.

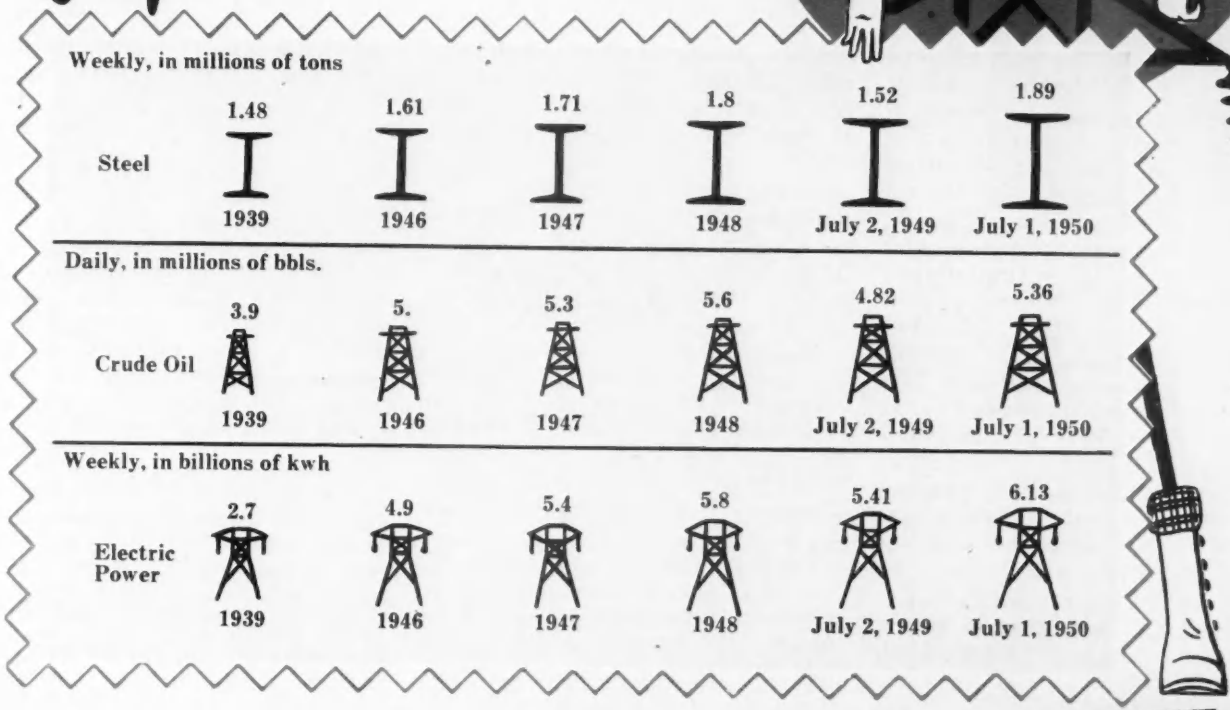
Mud costs range from $6500 to $13,000, using clear water to 7200 feet and then low water loss mud upon encountering Abo shale. Two mud pumps and 1 shale shaker used. Both excavated and steel pits and ditches employed. Drilling water plentiful.

Drilling costs at Bagley-Hightower vary, day rates ranging from $375 to $475 depending upon type of work, whether drill pipe, derrick, fuel, water, etc., are furnished. At Denton, prevailing footage rates are $10 to $11; and day rates vary from $450 to $550.



Arrows indicate new pre-Permian producing fields found during the past year in the extreme northwest sector of the Permian Basin. Pre-Permian fields are shown in solid black; fields producing from the Permian in a dotted pattern.

LCP* HEADS MAJOR BUSINESSES IN *Upward Trend*



Production statistics from U. S. Dept. of Commerce

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On July 1, 1950, the average weekly electric utilities output was 6.13 billion kilowatt hours — exceeding the percentages of production of steel and crude oil. Yes, Sir — that's me we're talking about — *LCP! Management has recognized my advantages and put me to work! The Power Engineer of your Utility Electric Power Company can tell you — I cost less to install, less to maintain, and I cut your payroll, too! See how I've proved myself the LOW COST POWER for the oil industry!

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PETROLEUM ELECTRIC POWER ASSOCIATION

West Texas IMPORTANT PLAYS New Mexico

PEGASUS-SWEETIE PECK FIELDS

Demonstrate Deep Possibilities in Midland Basin

THE Pegasus and Sweetie Peck fields have substantiated the belief that deep-seated structures in the Midland Basin area of West Texas may be highly productive and in multiple pays. They undoubtedly will encourage additional deep prospecting in this large area.

Production Data: Completions now total 15 for Pegasus, all producing from Ellenburger; and 3 for Sweetie Peck, 1 each in Devonian and Ellenburger and a dual well in the Wolfcamp and Pennsylvanian. Pegasus was discovered in March, 1949, and Sweetie Peck in March, 1950. Pegasus discovery also had good shows in Wolfcamp topped at 9350; flowing production in Pennsylvanian at 9912; and possibilities in Devonian at 11,120 feet and in Silurian at 11,880 feet. The Sweetie Peck discovery test showed possibilities in Spraberry topped at 7800 and in Wolfcamp at 9190 feet; while flowing production was indicated in Pennsylvanian at 10,022 and Devonian at 11,555 feet, and good shows were found in Silurian at 12,480 feet.

Productive limits remain speculative, particularly at Sweetie Peck where development has been restricted to close vicinity of discovery well. Upper zones are likely to cover much greater area than Ellenburger. Recovery of from 20,000 to 40,000 barrels seems reasonable for the Ellenburger. Additional reserves, perhaps several times that much in the aggregate, remain to be evaluated in pay zones above Ellenburger.

Both fields are asymmetrical anticlines, elongated north-south. Average depth of Ellenburger wells is 13,000 feet, with pay thickness ranging from 63 to 243 feet. Spacing pattern, 40 acres. Maximum allowable per well is 500 barrels daily for Pegasus and 445 barrels for Sweetie Peck. Crude is sweet 52-53 gravity. Gas-oil ratios are 1200 to 1600, for Pegasus and 900 to 1000 for Sweetie Peck.

Magnolia, Republic Natural Gas, Phillips and Sharples are principal operators at Pegasus; and General American, Gulf, Sinclair, Norwood, Benson and Trebol at Sweetie Peck. Magnolia Pipe Line serves Pegasus; Gulf Pipe Line serves Sweetie Peck.

Drilling Data: Pegasus has 15 rigs running and Sweetie Peck 8. Activity is increasing, with long development period ahead. Average Ellenburger completion time about 6 months, if no trouble encountered.

Typical casing program is 16-inch to 450 feet; 10¾-inch to 4800; 8⅝-inch to 9200 feet; 5½-inch to 12,500 and set 50 feet into Ellenburger pay; 4¾-inch open hole on down to total depth. Typical drill pipe program is 5-inch to 4800 feet; 4½-inch to 9200 feet; 3½-inch to 12,500; and 2⅞-inch to bottom. Drill collar program includes 8 8¾-inch collars to 4800 feet; 16 7-inch to 9200 feet; 16 4¾-inch to bottom. Average bit consumption is 1 20-inch; 16 13¾-inch; 40 9⅞-inch; 160 7⅜-inch; 5 4¾-inch; total 222 bits.

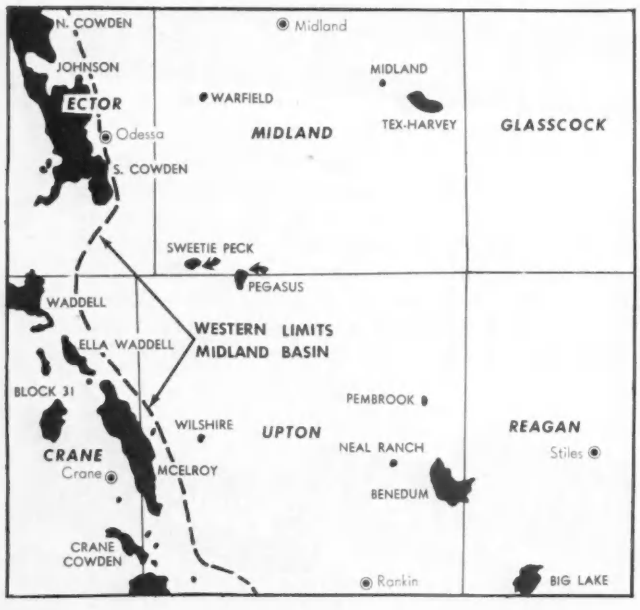
Fresh water mud usually is used to 9000 feet, though some wells mud-up above that point. Chemical mud (soda, quebracho) below 9000 feet; and 10-pound 45 sec. viscosity, 11 cc. water loss mud below 9200 feet. Some lost circulation is encountered below 6000 feet.

Rotary speeds average 100 rpm near surface, 40 rpm near bottom. Usual weight on bit is 60,000 pounds for upper zones; 35,000 in intermediate; and 10,000 pounds in lower zones. In completing, mud is displaced with water and acid treatment ranges from none to as high as 55,000 gallons. Some wells swab in.

Extra heavy duty power rigs of 14,000 to 20,000-foot capacities used. Field gas and either butane or propane used for fuel. Two mud pumps, one double-screen vibrating type shale shaker and elevated steel mud tanks generally used. Either 1 or 2 blowout preventers. Ample drilling water.

Drilling costs about $175,000 per well. Prevailing rates about $10 and up per foot. Fully equipped well costs from $275,000 to $300,000.

Nearest supply and machine shop centers are Midland, 35 miles north, and Odessa, 40 miles northwest. Good state highways near field. Caliche, sandy field roads. Flat terrain. Living accommodations for crews in Midland, Odessa and smaller communities.

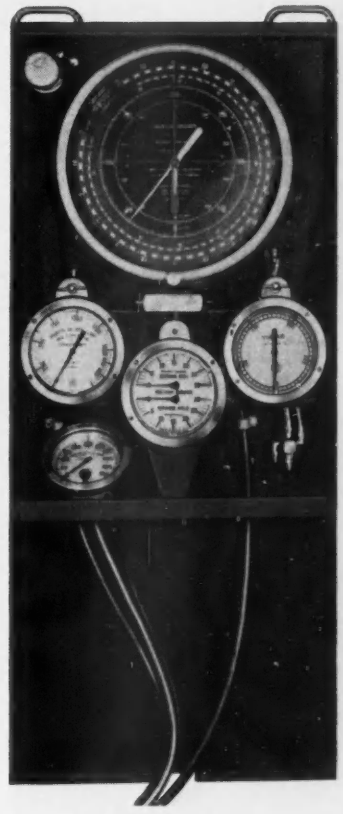


Arrows indicate the new discoveries of Sweetie Peck and Pegasus, which have created interest in the possibility of finding deep-seated multiple-play structures in the extreme western portion of the Midland Basin.

HERE is your STREAMLINED

Martin-Decker HYDRO-MECH TORQUE GAUGE

- Saves chain
- Increases footage on deep wells
- Increases footage when drilling with small bits
- Indispensable for milling, cutting jobs and DIAMOND CORING



Indicating Gauge can be installed as an individual unit or as an integral part of other Martin-Decker Controls.

For ALL rigs with Chain-Drive Rotaries

The Martin-Decker Hydro-Mech Torque Gauge installed as a rubber-cushioned rotary chain idler provides a remarkably sensitive direct mechanical-hydraulic method of measuring the torque in drill pipe It is a simple instrument, easy to install and easy for the driller to read and understand. The assembly consists of a load-sensitive element — chain idler, load-responsive cylinder high-pressure hose, damper, and 6-inch "rotate-able" dial indicating gauge

The idler is placed beneath the tight side of the chain between the drawworks and the rotary machine It consists of a synthetic rubber-tired wheel mounted on a lever arm which actuates a piston in the pressure transmitter The wheel contacts the under side of the chain, and as the chain raises and lowers under the influence of varying loads, the lever arm moves up or down, decreasing or increasing the pressure in the transmitter After the installation is completed, the roller height is adjusted by pumping fluid into the system with a small hand pump Adding fluid to the cylinder raises the roller, deflects the rotary chain, and increases the pressure in the hydraulic system. The amount of rotary chain deflection depends solely on the point on the indicating dial face which the driller wishes to use for torque reference.

Torque built up in the drill string tends to straighten the deflected rotary chain As torque increases, the rotary chain increases its downward force against the chain idler wheel. The force thus exerted on the wheel develops fluid pressure in the cylinder and that pressure is transmitted through the high-pressure hose to the indicating gauge at the driller's position In this manner, drill pipe torque above or below the established reference point on the gauge is indicated instantly The dial gauge is mounted either in the Instrument Panel or nearby in easy view of the driller A high-pressure hydraulic hose with self-sealing coupling connects the cylinder in the load element to the dial gauge

"Rotate-able" Dial Permits Gauge Setting To Indicate Net-Torque-On-Bottom

The gauge is designed with a "rotate-able" dial permitting the driller to zero out friction on drill pipe thus, the gauge indicates net-torque-on-bit This feature is especially valuable in assisting the driller on wells where friction from any cause tends to absorb weight during drilling operations The torque built up by rotation before weight is applied to the bit is measured by the gauge but is zeroed off by means of rotating the dial to zero, then as weight is applied, the work being done by the bit at the bottom of the hole is instantly reflected by increased readings above the zero reference point on the gauge.

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PAYS FOR ITSELF IN A FEW HOURS . . . in time and equipment savings when milling, washing over, running diamond core heads, directional and deep hole drilling.

•

Adaptable to all rigs with chain-drive rotary tables.

•

The torque gauge that operates on diesels.

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REMARKABLE SENSITIVITY— Responds to very small changes in torque.

•

Can be set for net-torque-on-bottom with "rotate-able" dial adjustable by rotation through 360° — zeros out hole friction, allowing work load at bit only to be measured.

•

Easy to install and easy to adjust to any chain.

•

Easy to move from well to well.

•

Stabilizes the chain and gives longer chain life.

•

Can be furnished for single- or double-link chain.

•

A SIMPLE INSTRUMENT — Easy to read and easy to understand.

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Minimizes danger of twist-offs.

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IMPORTANT PLAYS

West Texas New Mexico

Goldsmith 5600 Pool

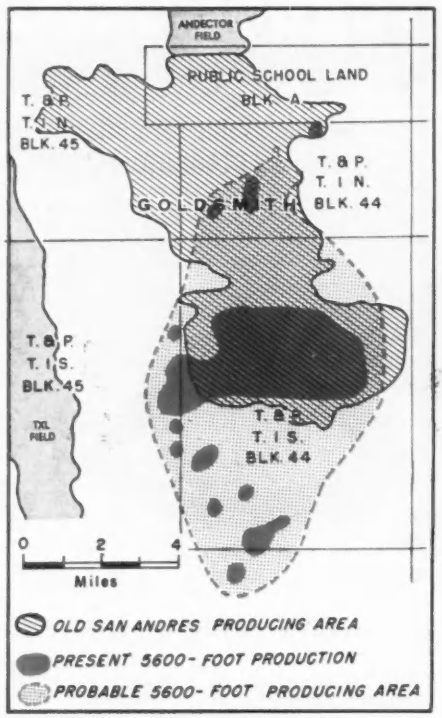
Outstanding for Proved Undrilled Locations

THE Goldsmith field represents a major production and reserve spot of West Texas, which remains in the limelight through the discovery of new producing formations. Although an active producer since 1934 and site of about 1300 producing wells, the field still is one of the outstanding drilling opportunities in the Permian Basin.

The field originally produced from the 4200-foot San Andres formation. The Clear Fork was proved productive at 6100-6200 feet in 1946; the Devonian at 7885-7980 feet in March, 1947; the Ellenburger at 9465-9500 feet in September, 1947; and the Upper Clear Fork (commonly called the 5600-foot field) in November, 1947. Currently the field has more than 1000 San Andres producers, more than 150 in the 5600-foot Clear Fork; 110 in the 6100 to 6200-foot Clear Fork; 5 in the Devonian; and 3 Ellenburger wells. The possibility exists that more pre-Permian production will be developed.

5600-Foot Production Data: Interest currently is focused almost exclusively on the 5600-foot Upper Clear Fork zone, which is estimated to have between 250 and 300 undrilled proved locations. During the past 12 months, productive limits of this new horizon have been expanded in all directions until it has been proved over an area measuring 5½ miles east to west and 10 miles in a north-south direction. Although much of the 5600-foot production overlaps the regular 6100-6200 Clear Fork area covering the south part of Goldsmith, the formation also has been proved to extend 3 miles farther south beyond previous limits. Much of the intervening area has not yet been drilled. There also is a large undrilled area about 2½ miles long between the northernmost 5600-foot wells and the more densely drilled central area.

Producing formation top ranges from 5350 to 5875 feet, with broken pay thickness varying from 110 to over 200 feet. Average total depth is 5800 feet. Forty-acre spacing pattern is used, with some wells dually completed in 5600-foot and regular Clear Fork at 6100-6200 feet.



The Goldsmith field remains a leader in West Texas activity. Developments the past year have proven a large undrilled area for 5600-foot Upper Clear Fork production, as shown by above map.

Initial production ranges from several hundred up to more than 1500 barrels daily on ½- to ⅜-inch bean, with some wells encountering isolated "islands" of low porosity in some sectors. Gas-oil ratio average 600 to 800 cubic feet. Maximum base allowable up to 108 barrels daily. Crude is semi-sweet of 38 to 39 gravity. Gulf and Phillips provide pipe line outlets.

Principal operators are: Gulf Oil; Phillips Petroleum; Stanolind Oil and Gas; Forest Oil; Mid-Continent Petroleum; Atlantic Oil; DeKalb Agriculture Association; and E. C. Lawson.

5600-Foot Drilling Data: From 17 to 20 rigs are running in area. Typical casing program is to set 9⅝-inch at 1500 feet with 800-1000 sacks of cement; 7-inch slightly above pay around 5400 feet with 600 sacks; and open hole to bottom. Completion usually includes displacing mud with oil; washing of open hole with acid; then treating with 1000 to 2000 gallons of acid. Some operators set casing to bottom and complete through perforations. Multiple-stage acidizing is common, depending upon porosity and permeability conditions.

Both 3½ and 4½-inch drill is used. One bit is required to drill the 1500-foot 12¼-inch hole, where rotary speeds range from 100 to 110 rpm. The 8¾-inch hole down to around 5400 feet requires from 30 to 32 bits, in which section 18 6¼-inch drill collars are used with bit weights of 40,000 to 45,000 pounds and rotary speeds of 100 to 110 rpm. Four to 6 bits are used in the 6¼-inch hole section, where 4 to 6 4¾-inch drill collars are used with bit weights of 15,000 to 25,000 pounds and rotary speeds of 55 to 65 rpm.

Clear water mud is used to 3900 feet; mud mixed to protect regular Goldsmith 4200-foot pay; salt mud to bottom. There is some danger of blowouts in upper 4200-foot San Andres section, where 1200-1500-pound formation pressures are encountered. Lost circulation materials sometimes required in San Andres. Two mud pumps with 1 shale shaker, and 2 blowout preventers used.

Average rigging up time is 1 day, and average completion time 35 days. Power rigs of jackknife or medium depth derrick type are employed, using lease gas for fuel. Drilling water available from wells on lease.

Drilling costs average $33,000 per well. Fully equipped well costs about $65,500. Prevailing footage rates about $5. Day rates are $650 with drill pipe and $550 without drill pipe.

Odessa, 15 miles away, offers good supply and machine shop facilities. Highways are nearby and field roads good.

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HERE'S THE **WELDMENT** THAT THE CASTING REPLACED

West Texas
IMPORTANT PLAYS
New Mexico

DOLLARHIDE FIELD

Shallower Clear Fork Now Holds Attention

DOLLARHIDE, outstanding as a source of prolific and thick Silurian producing section and as a Devonian producer, also is representative of the recent discovery of important shallower production in several West Texas fields. Although productive in Devonian since August, 1945, Silurian since January, 1947, and Ellenburger since October, 1947, the first Clear Fork production was not found until June, 1949. Peak development of the 3 older zones recently passed, and attention now is centered on the Clear Fork. Development of this shallower formation seems destined to embrace a greater area than the older beds, particularly in the north sector of the field, and may provide as many as 100 additional wells. In addition, the Wichita-Albany zone, next possible producing zone below the Clear Fork, has shown promise on drill stem tests. Multiplicity of pays has made it possible to utilize dual completions to a greater extent than in any other West Texas field.

Production Data: Like many other fields in the Central Platform area of West Texas, Dollarhide is a north-south trending anticline. It has steep drop-off along east side. Depending upon position on structure, the Clear Fork, with 16 wells, is topped at 6285 to 6680 feet with from 28 to as much as 300 feet or more open to production; Devonian, with 95 wells, is topped at 7515 to 8250 feet with from 30 to 115 feet of pay section; Silurian, with 53 wells, is topped at 8200 to 8700 feet with from a few feet up to 200 of pay; Ellenburger, with 45 wells, is topped at 9850 to 10,125 feet with from 20 to 180 feet of pay. Spacing pattern is 40 acres. Most wells are flowing. Maximum base allowable per well, as of July 1, was 91 barrels daily from Clear Fork; 100 barrels for Devonian; 159 for Silurian; and 200 barrels for Ellenburger. Crude ranges from sour to sweet in lower zones.

Principal leaseholders are Cities Service; Humble; Magnolia; Union Oil and Pacific Western. Field has 2 pipe line outlets, Humble and Texas-New Mexico.

Drilling Data: Ten rigs currently are running in field. Casing programs vary according to section of field, pay in which completed and whether single or dual completion. Typical program is 10¾ or 13⅜-inch to 420 feet; 7⅝ or 9⅝-inch to 3200 feet; and 5½ or 7-inch to total depth. Cementing practice calls for 2 stage operations to prevent loss of cement in pay zone. Common practice is to cement up to shoe of previous upper string. Most wells are cased to bottom, perforated and acidized.

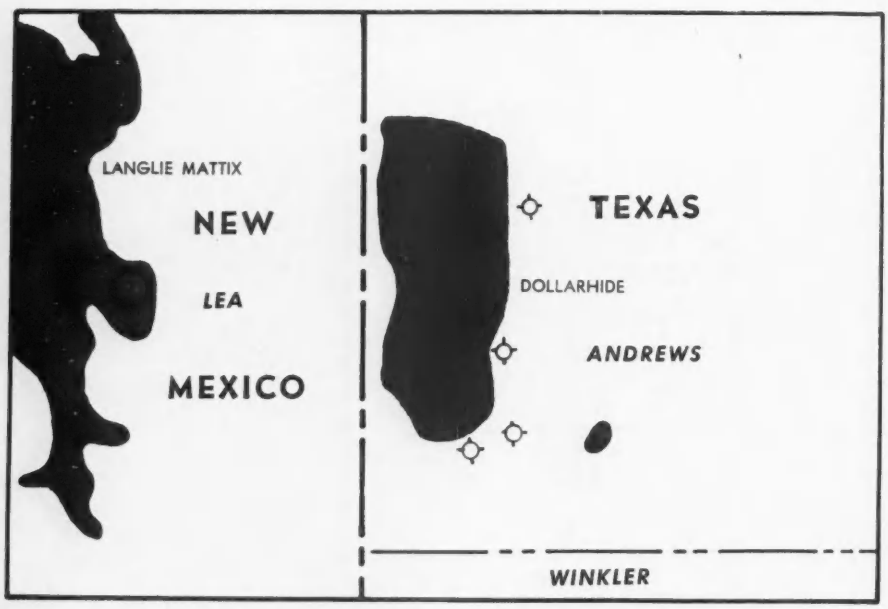
Drill pipe generally is 4½-inch all the way, with 15 to 20 6¼-inch drill collars. Bit consumption on 10,000-foot wells averages 1 15- or 18-inch; 12 9⅞- or 12¼-inch; 100 6¾- or 8¾-inch. Proportionately fewer bits used on shallower wells. Typical rotary speeds are 45 to 60 rpm, and usual weight on bit 30,000-40,000 pounds.

Mud costs range from $3500 to $5000 for Ellenburger wells, less for shallower wells. Difficulty encountered with lost returns, particularly in cavernous Silurian zone. Little danger from blowouts if normal precautions followed.

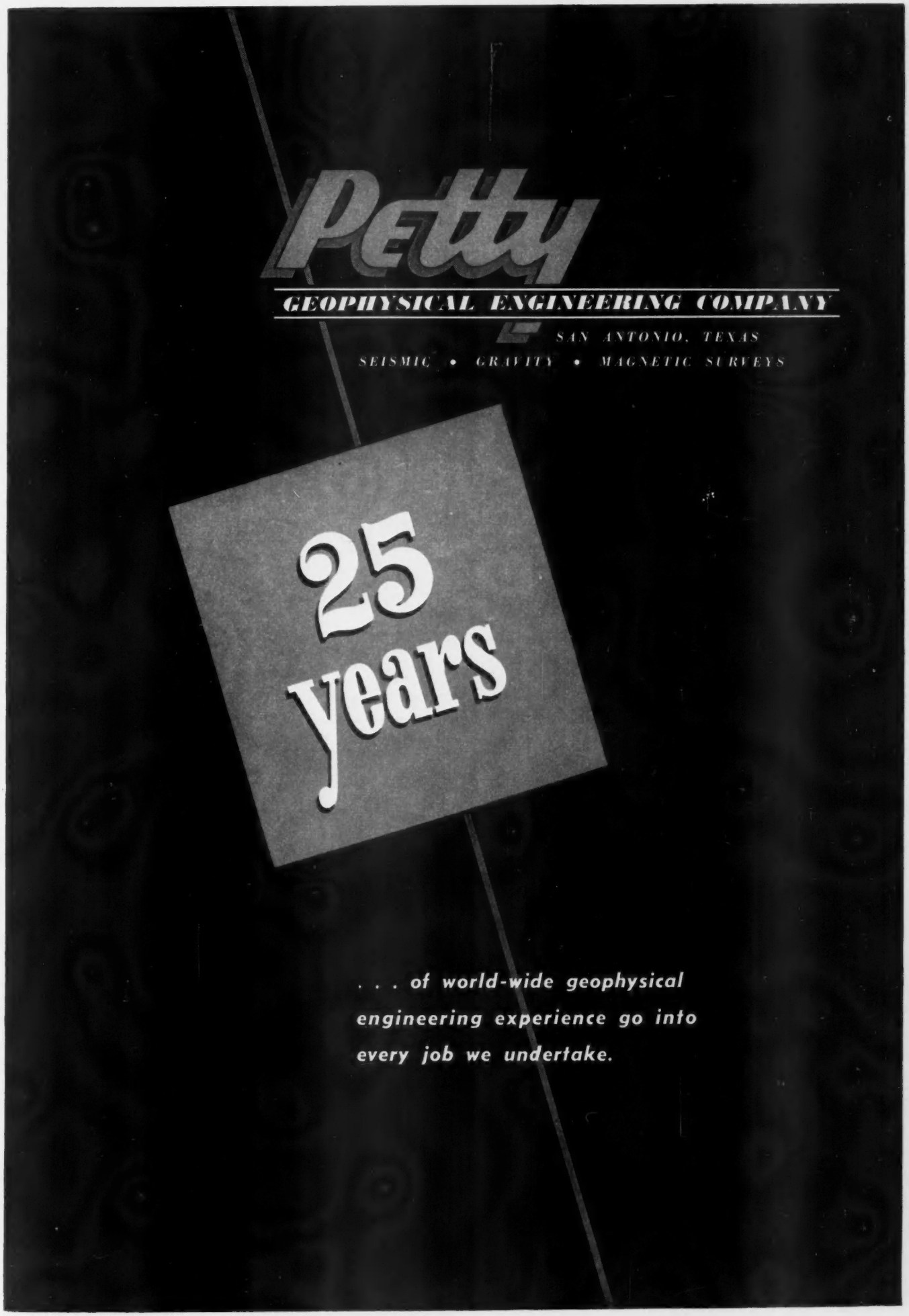
Power type heavy-duty rigs do bulk of pre-Permian drilling; medium rigs used for shallower Clear Fork drilling. Lease gas available for fuel. Heavy rigs usually have 2 mud pumps and 2 blowout preventers. One vibrating screen shale shaker required. Pits and ditches are excavated. Rigging up time 2 to 3 days. Average completion time to Ellenburger is 100 to 110 days. Drilling water is scarce and expensive; often piped 6 to 10 miles from New Mexico sources.

Drilling costs range from $80,000 to $160,000, depending upon depth and whether single or dual completion. Prevailing footage rates: $7 to $8 per foot. Day rates are $400 standby; $600 without drill pipe; and $750 with drill pipe.

Nearest supply and machine shop center is 8 miles distance at Jal, N. Mex.; or 27 miles away at Kermit, Texas. Paved highway through field. Good caliche lease roads. Living accommodations for crews at Andrews, 35 miles; Eunice, 30 miles; Jal or Kermit.



The Dollarhide field promises to remain active for sometime because of the discovery of Clear Fork production a year ago. The producing limits of Clear Fork may embrace a greater area than the older previously productive beds, particularly in the north sector of the field.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Exploration

For July at New High

EFFORTS to find new sources of oil reached an all-time high in the U. S. during July, but results were not as satisfactory as normally. The 782 exploratory tests completed during July compared with 757 in June and the previous peak of 770 in May.

However, only 18.2 percent of the July tests found oil, gas or distillate production, whereas 24.6 percent were productive in June and May was near the average of 19.6 percent. The record attempt to discover new oil producing sources included the completion of 640 dry holes, in contrast with only 575 failures in June and 619 in May. Only 113 new fields and pays were found in contrast with 144 in June; while extensions to previously proven fields totaled but 142 against 182 in the preceding month.

Due principally to the unusually high rates of the past three months, 10.7 percent more exploratory tests were completed during the first 7 months of this year than in the same period of 1949, there being 4722 completions the first 7 months this year in contrast with 4266 during that period in 1949.

Summary of Results of Exploratory Drilling

ITEM	July, 1950	June, 1950	SEVEN MONTHS January-July 1950	1949	Percent Diff.
Oil Discoveries	98	118	622	585	+ 6.3
New Fields	78	84	457	401	+ 14.0
New Pays	20	34	165	184	— 10.3
Distillate Discoveries	9	10	50	88	— 43.2
New Fields	5	8	40	43	— 7.0
New Pays	4	2	10	45	— 77.8
Gas Discoveries	6	16	78	81	— 3.7
New Fields	5	15	70	67	+ 4.5
New Pays	1	1	8	14	— 42.9
Total Discoveries	113	144	750	754	— 0.5
Extensions to Fields	29	38	194	152	+ 27.6
Oil Fields	23	37	172	136	+ 26.5
Distillate Fields	3	.....	7	10	— 30.0
Gas Fields	3	1	15	6	+150.0
Total Prod. Tests	142	182	944	906	+ 4.2
Dry Holes	640	575	3,778	3,360	+ 12.4
Wildcats	626	561	3,646	3,315	+ 10.0
New Pays	.....	1	6	7	— 14.3
Outposts	14	13	126	38	+231.6
Total Exploratory Tests	782	757	4,722	4,266	+ 10.7
Percent Productive	18.2	24.0	20.0	21.2	.....
Percent Dry	81.8	76.0	80.0	78.8	.....

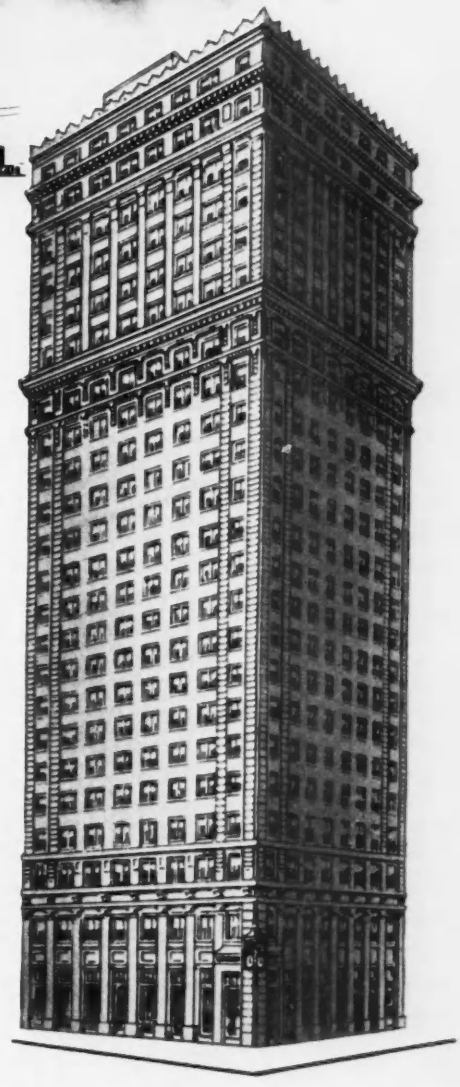
(See Tables on 104-108)

Results of Exploratory Drilling in July and First Seven Months, 1950-1949, by Districts

State or District	MONTH OF JULY, 1950													FIRST SEVEN MONTHS, 1950																
	Productive Tests									Total Productive	Unproductive Tests			Total Exploratory Tests	Productive Tests								Total Productive	Unproductive Tests				Total Dry	Total Exploratory Tests	
	New Fields			New Pays			Extensions								New Fields			New Pays			Extensions									
	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas		Wildcats	New Pays	Outposts		Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas	7 Mo. 1950	7 Mo. 1949	Wildcats	New Pays	Outposts	7 Mo. 1950	7 Mo. 1949	7 Mo. 1950	7 Mo. 1949
Alabama											4			4	1		1							2		12			12	10	14	10
Arizona											3			3												3			3	4	3	4
Arkansas	1									1	12			13	5	1		1			1			8	10	52		2	54	37	62	47
California	2						4			6	41		1	48	12		1	5		1	13		1	33	31	203	3	10	216	195	249	226
Colorado											7			7	1									1		24		1	25	24	26	24
Florida																										6			6	9	6	9
Georgia																										4			4	4	4	4
Idaho																										3			3		3	
Illinois	1			2			3			6	85			91	13			11			40		1	65	59	399			399	308	464	367
Indiana	5			1			2			8	35			43	22			4			3			29	33	253		7	260	232	289	265
Kansas	10		1							11	54			65	59		4							63	53	334			334	229	397	282
Kentucky											14			14	5		1	1			1			8	8	40			40	26	48	34
Louisiana	2			1	3			2		8	24			32	15	8	2	11	7	2	8	2	1	56	71	118	1		119	137	175	208
North Louisiana					2					2	11			13	2	1		1	4	2	5		1	16	18	52	1		53	71	69	89
South Louisiana	2			1	1			2		6	13			19	13	7	2	10	3		3	2		40	53	66			66	66	106	119
Maryland																										1			1		1	
Michigan											35			35	16		4	1			1			22	18	157			157	176	179	194
Mississippi											12			12	8	2		1				2		13	6	86		3	89	66	102	72
Missouri											1			1												3			3	5	3	5
Montana							1		1	2	2			4							2		1	3	5	28			28	19	31	24
Nebraska	2									2	7			9	3		1				1		1	6	1	27			27	2	33	3
New Mexico							1			1	7			8	9			4			7			20	11	39		4	43	30	63	41
Ohio									1	1				1							1		2	3	3	6			6	21	9	24
Oklahoma	5	1		3	1		3			13	34			47	47	1	4	20	1		24	1	1	99	68	284			284	257	383	325
Pennsylvania																														1		2
South Dakota																										2			2	2	2	2
Tennessee																										4			4	10	4	11
Texas	48	4	4	13		1	8	1	1	80	235		11	326	235	28	52	101	2	5	67	2	7	499	498	1502	1	94	1597	1479	2096	1977
Dist. 1 S. Central	1									1	16			17	8	1	1							11	11	111		2	113	139	124	150
Dist. 2 Middle Gulf				4					1	5	16			21	7	4	10	9	1	1			3	35	44	76		7	83	97	118	141
Dist. 3 Upper Gulf	5	3		3		1	1	1		14	22		1	37	11	8	3	22	1	2	7	2	3	59	83	117		12	129	143	188	226
Dist. 4 L. Gulf-SW	2		1	1						4	13			17	14	5	16	25		1				61	73	168		3	171	219	232	292
Dist. 5 E. Central			1							1	7			8	2		1				1			4	4	40			40	43	44	47
Dist. 6 Northeast		1								1	4		1	6	5	4		2			2		1	14	15	43	1	5	49	41	63	56
Dist. 7-B N. Central	16		1							17	67		1	85	85	3	9	9			5			111	108	341		16	357	332	468	440
Dist. 7-C W. Central	6			1						7	17			24	14	2	2	6			5			29	22	102		10	112	57	141	79
Dist. 8 West	5			3			3			11	25			36	36			21			29			86	53	155		14	169	114	255	167
Dist. 9 North	13		1	1			4			19	47		8	74	52	1	10	7			18			88	84	342		25	367	290	455	374
Dist. 10 Panhandle											1			1	1									1	1	7			7	4	8	5
Utah																		1						1	3	5			5	8	6	11
Washington															1									1		1			1		2	
West Virginia																									5				1		6
Wyoming	2						1			3	14		2	19	5			4			3			12	21	50	1	5	56	68	68	89
Total U. S.	78	5	5	20	4	1	23	3	3	142	626		14	782	457	40	70	165	10	8	172	7	15	944	906	3646	6	126	3778	3360	4722	4266

World Leadership

IN OIL AND GAS



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Texas has gained a position in world oil and gas production which reads like a fairy tale.

This favored area accounts for more than 40% of U. S. petroleum production or 22% of the entire world's production.

It also accounts for 44% of the nation's natural gas production.

In underground reserves its position is even stronger . . . 53% of estimated U. S. petroleum reserves . . . 51% of estimated natural gas reserves.

Houston is the hub of the state's oil and gas industries. Now the nation's second port, partly as a result of the Port's huge tonnage of petroleum and petroleum products, Houston is the major terminal of 36,500 miles of oil pipe lines which serve the state's producing areas. The 19 counties comprising the immediate Houston area, though constituting only 6% of the state's area, produce 20% of its petroleum and contain 40% of its refining activity. These factors have made Houston the key city in the world's oil and gas activities.

Vital to the development of these great industries has been adequate and progressive banking service. Second National has been providing such service for 43 years. The Oil and Gas Division of this old-established institution is nationally recognized for its specialized experience, constructive cooperation and affirmative attitude towards sound oil and gas developments.

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The **SECOND NATIONAL BANK OF HOUSTON**

MAIN AT RUSK

CAPITAL AND SURPLUS TEN MILLION DOLLARS . . . MEMBER F. D. I. C.

New Oil, Distillate and Gas Fields and New Pay Horizons Discovered in the United States in July, 1950

Also Important Extensions to Established Fields

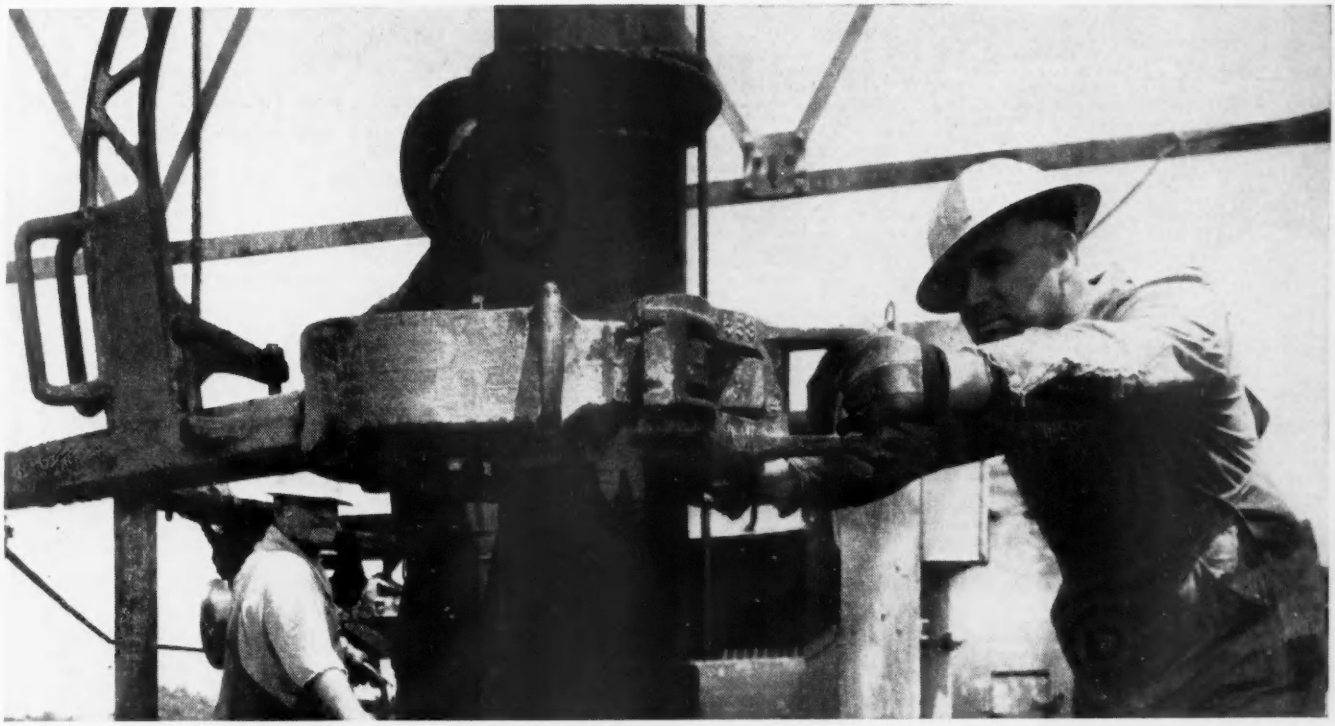
COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Production Method and Choke	Gravity of Oil
		ARKANSAS—New Oil Field						
Union		Claude A. Lee's E. V. White 1, Sect. 36-17s-15w, 1½ mi w Nick Springs	7-31-50	3291	2476- 2479	Meakin sd; U. Cre.	F 15; 1 mln.; 1/8"	24
		CALIFORNIA—New Oil Fields						
Kern		Ferguson & Bosworth's Layman 2, 1540 s 1100 e fr cent. 18-28s-20e. 1 mi se McDonald Anticline fld.	7-10-50	2057	2000- 2008	Buttonbed sd; Mio.	P 300	30
Kings		Goshen Syndicate's Drummond-Union 2, 920 n 1628 e fr sw cor. 36-18s-22e. 20 mi se Riverdale.	7-23-50	5404	5244- 5252	Miocene	P 92	20.2
		CALIFORNIA—Oil Field Extensions						
Kern	McKittrick-Belgian Anticline	Pacific Western & Tide Water's Rankin 82-A-31, Sect. 31-30s-22e. ½ mi. s extension.	6-27-50	5493	5400- 5477	Oceanic sd; Eoc.	F 1282; 3/8"	35
Kern	Tejon Hills, SW.	Standard Oil Co's Tejon Ranch 3-66, Sect. 21-11n-18w	6-28-50	545	446- 510	Sta. Margarita sd; Mio.	P 179; 84 wtr.	28.9
Los Angeles	Newhall	E. M. Breen's Betsy Linda 2, Sect. 1-3n-16w. 1 mi n extension	6-27-50	1262	1081- 1132		P 12	11
Ventura	Ventura Ave.	Lloyd Corp., Ltd's Sexton 1, Sect. 19-3n-22w. 1 mi e extension	6- 9-50	13450	12602-13448	D-7 sd; Plio.	P 343	31.8
		ILLINOIS—New Oil Field						
Hamilton	Flannigan	Stewart Oil Co's Johnson 1, NW SW NW 28-6s-5e. 1¾ mi sw Rural Hill fld.	8- 1-50	3253	3240- 3250	Aux Vases sd; Miss.	P 148; 8 wtr.	....
		ILLINOIS—New Oil Pays						
Franklin	Akin, W.	Taylor & Schumaker's U. S. Coal & Coke 6, SW SW 16-6s-4e	7- 3-50	2716	2698- 2714	Cypress sd; Miss.	P 50; 1 wtr.	....
Hamilton	Cantrell, S.	George & Wrather & W. Duncan's R. Hunro 1, NE NW 18-7s-5e	7-18-50	3210	3110- 3134	Aux Vases sd; Miss.	P 300	....
		ILLINOIS—Oil Field Extensions						
Edwards	Bone Gap, S.	Robinson & Puckett's Coale Cons. 1, NW SE 20-1s-14w. ¾ mi e ext	8- 1-50	3050	3042- 3047	Rosiclare li; Miss.	P 90	....
Richland	Ritter	J. Stapp's S. Dobbs 1, SW 30-3n-11e. ½ mi extension	7-11-50	3248	3238- 3242	McClosky li; Miss.	F 1056	....
Wabash	Rochester	J. Reznik's H. C. Waddle 1, NW NE SE 22-2s-13w. ¾ mi sw extension	7-18-50	1969	1950- 1969	Waltersburg sd; Miss.	P 105; 20 wtr.	....
		INDIANA—New Oil Fields						
Dubois		Inland Production & A. W. Cherry's M. Miller 1, NE NW SW 12-2s-13w	7-20-50	2400	2330- 2335	McClosky li.; Miss.	P 4	....
Gibson		Ashland-Buchman & O'Neal's Flora B. Mounts 1, SE SW 19-3s-11w. 2½ mi s Owensville.	7-29-50	2601	2482- 2489	Aux Vases li; Miss.	P 26	....
Knox	Sandborn	B. L. S. Drilling Co's Schloot Hrs. 1, NW SE SW 2-5n-7w. 6 mi fr Plainville fld.	7- 7-50	1250	878- 887	McClosky li; Miss.	P 40; 10 wtr.	....
Posey	Griffin, E.	George Schoonmaker's Thos. F. Mumford 1, NE NE NE 7-4s-13w	7-12-50	2565	2546- 2565	Cypress sd; Miss.	P 30	....
Posey		H. D. Atha's W. Willman 1, SE NE SW 18-6s-12w	7-26-50	2818	1850- 1862	Waltersburg sd; Miss.	P 35	....
		INDIANA—New Oil Pay						
Posey	Griffin, E.	Calvert-Aurora-S. Lewis & Mahutska's E. B. Mumford 1, SE SE NW 33-3s-13w.	7- 8-50	2010	1764- 1774 1843- 1850	Degonia sd; Miss. Palestine sd; Miss.	F 402	....
		INDIANA—Oil Field Extensions						
Gibson	Francis, W.	George & Wrather's Wm. Temme 1, SW SW SE 25-2s-10w. ¾ mi ext.	7-28-50	1884	1880- 1884	Aux Vases li; Miss.	P 25	....
Gibson	Union-Bowman	J. C. Haynes & J. R. Grandin et al's Edwin Thompson 2, SE NW SW 2-1s-10w. s extension.	7- 6-50	1736	1721- 1736	Aux Vases li; Miss.	P 100; 20 wtr	....
		KANSAS—New Oil Fields						
Barton	Batchman	Anschutz Drilling Co's Batchman 1, SE SE SE 19-20s-12w. 1 mile ne Rolling Green E. fld.	7-17-50	3480	3458- 3480	Arbuckle li; Ord.	P 180	34
Barton		Darby & Bothwell's Underwood A-1, NE SE NE 15-17s-13w. 1 mi n Hoisington fld.	7-25-50	3348	3342- 3348	Arbuckle li; Ord.	P 45	....
Elk	Fleming	Sam Pack's Rader 1, SE SE SE 8-29s-9e. 2½ mi ne Porter fld	7-12-50	2660	1656- 2660	Arbuckle li; Ord.	P 50	....
Graham	Bass, N.W.	Jones, Shelburne & Farmer's Miller 1, NW NW NW 11-10s-21w. 3 mi w Morel fld.	7-16-50	3849	3841- 3849	Arbuckle li; Ord.	P 2000	....
Graham	Ironclad	C-G Drlg. & D. G. Hansen's Sutor 1, SE SE SW 23-9s-22w. 1 mi n Fargo fld.	7-14-50	3919	3756- 3760	Lansing-K.C. li; Penn.	P 176	....
Graham	Teall, N.	Heathman Drlg. Co's Abiram 1, NE NE SW 4-10s-21e. 1 mi n Teall fld.	7-10-50	3873	3870- 3873	Arbuckle li; Ord.	P 339	....
Saline		Chas. Sheldon's Olson 1, NW NW NE 11-16s-3w	7-18-50	3413	3390- 3413	Viola li; Ord.	P 55	....
Stafford	Dell	Petroleum Inc.'s Brown B-1, NE NE NW 7-21s-13w. 2 mi n Pundsack, N. fld.	7-13-50	3654	3446- 3459	Lansing-K.C. li; Penn.	Sw 119	33
Stafford		Vickers Pet. Co's Frey 1, SW SW NE 7-21s-14w. 4 mi sw Pritchard fld.	7-28-50	3722	3716- 3722	Arbuckle li; Ord.	P 2392	40
Sumner	Tate	Ben Gralapp's Barnett 1, C SE NW 31-32s-2e	7-14-50	3726	3705- 3726	Simpson sd; Ord.	P 30	....
		KANSAS—New Gas Field						
Meade		Skelly Oil Co's McKinney 1, NW NW NE 2-34s-26w	7-26-50	7686	5762- 5792	Mississippian li; Miss.	15 mln.	....
		NORTH LOUISIANA—New Distillate Pays						
Claiborne	Lisbon	H. W. Klein's Lowery-Rogers Unit 1, Sect. 14-20n-5w	7-25-50	9025	8818- 8828	"E" sd; Jur.	F 37; 1.3 mln; 3/8"	56
Webster	Shongaloo	Stanolind & Continental's Mitchell 1 (OWWO), Sect. 31-23n-9w	7- 6-50	11295	10145-10287	Mitchell sd; Jur.	F 60; 1 mln; 3/8"	....
		SOUTH LOUISIANA—New Oil Fields						
Cameron		Superior's Miami Corp. L-1, Sect. 34-13s-5w. 2 mi se Lake Misere	7-16-50	13751	8890- 8896		F 189; 1/2"	54.9
Rapides	Glenmora	Texas Pacific C&O Co's W. W. Elliott 1, C NW SW 35-1s-2w. 4 mi s & 2 mi e Glenmora.	7-29-50	10812	10699-10714	Wilcox sd; Eoc.	F 191; 1/8"	39.4
		SOUTH LOUISIANA—New Oil Pay						
Iberia	Weeks Island	Shell's Weeks Island State A-7, Sect. 13-14s-6e	7-30-50	10016	3742- 3750		F 127; 1/2"	32.4
		SOUTH LOUISIANA—New Distillate Pay						
Assumption	Napoleonville	Thomas Jordan Inc.'s Kessler-Sternfels 1 (OWWO), Sect. 33-12s-13e	7- 3-50	8888	8820- 8836		F 48; 2.6 mln.	50.8
		SOUTH LOUISIANA—Distillate Field Extensions						
Acadia	Bayou Mallet, S.	Union Sulphur Co's Willie Bellard 1, Sect. 27-7s-1e. 1 mi w extension	7- 7-50	9650	9578- 9596	Miocene	F 27; 1.0 mln; 3/64"	54.8
Cameron	Lakeside	Stanolind's The Lacassine Co. Inc. 1, Sect. 23-12s-5w. ½ mi w extension	7-15-50	11300	9974- 9990	Miocene	F 23; 1.1 mln; 1/8"	51.6
		MONTANA—Oil Field Extension						
Pondera	Pondera	E. B. Emrick's Lederer 1, NE SE SE 13-27n-4w. 1½ mi e extension	7-11-50	1942	1937- 1942	Ellis-Madison li; Miss.	Sw 100	....
		MONTANA—Gas Field Extension						
Toole	Arch Apex	Arch Apex Oil Corp's Gordon Christian 1, C SE SW 32-37n-3e	7-16-50	2924			0.3 mln; open	....
		NEBRASKA—New Oil Fields						
Cheyenne	Huntsman, SW.	Ginther, Warren & Ginther et al's Clarence Dorman 1, SW SE NE 23-14n-50w. 3 mi sw Huntsman fld.	7-18-50	4696	4650- 4669	"D" sd; U. Cre.	P 352	....
Harlan		Alpine O&R & B&R Drlg. Co's Fischer 1, SW SW SE 33-1n-18w	7-13-50	3450	3366- 3375	Lansing-K.C. li; Penn.	P 168	....
		NEW MEXICO—Oil Field Extension						
Eddy	Turkey Track	Jones & Watkins' Miller 1, SE SE SE 9-19s-29e. ¾ mi sw extension	6-20-50	2163	2132- 2163	Queen sd; Perm.	F 240	37.1
		OHIO—Gas Field Extension						
Summitt	Medina	Ed Obermiller et al's Carlos Workman 1, Lot 81, Bath Twp.	7-13-50	3235	3215- 3235	Newburg sd; Sil.	0.2 mln.	....
		OKLAHOMA—New Oil Fields						
Cleveland	Stella, E.	Gulf's Wilson Est. 1, NE NW NE 27-10n-1e. 4½ mi w Union Point	7-20-50	6286	6072- 6119	Trenton dolo; Ord.	F 988	37.4
Creek		Falcon Seaboard's Kimble 1, NW SW SW 22-14n-10e. 5/8 mi e Tuskegee	7-23-50	3394	3258- 3264	Misener sd; Miss.	P 20; 50 wtr.	....
Grant	Salt Fork, SW.	Sunray & Davon's Kelly 1, SW SW SW 27-25n-4w	7-12-50	6168	6007- 6086	Wilcox sd; Ord.	P 18; 25 wtr.	47
Logan		Ashland's Ficken 1 (OWWO), E½ SW NE 8-19n-4w. 1½ mi n Marshall	7-22-50	6443	6374- 6398	2nd Wilcox sd; Ord.	P 32; 68 wtr.	41
Pawnee		L. L. Welker's J. R. Welker 1, SW NE SE 23-23n-5e	7-14-50	3713	3325- 3354	Wilcox sd; Ord.	P 8; 90 wtr.	....
		OKLAHOMA—New Oil Pays						
Cleveland	Clothier, SW.	Herman Brown's Miller 1, NW NW NW 32-10n-2w	7-21-50	8156	7992- 8044	Oil Creek sd; Ord.	F 320; 3/8"	38
Pontotoc	Center	G. L. Gallaspy's Gray 3, NE NW NW 19-4n-5e	7- 7-50	1598	1292- 1302	Hunton sd; Devo.	P 60	38.8
Pottawatomie	Rover, N	Deep Rock's Dejarnette 1, NE NE NE 17-6n-3e	7- 6-50	4669	4260- 4280	Fernvale-Viola li; Ord.	F 384; 1/4"	....

[1] Character of producing formations abbreviated thus: ch, chalk; dolo, dolomite; li, limestone; sd, sandstone; sh, shale; ser, serpentine; cgl, conglomerate. Ages of formation abbreviated thus: Plio, Pliocene; Mio, Miocene; Olig, Oligocene; Eoc, Eocene; U. Cre, Upper Cretaceous; L. Cre, Lower Cretaceous; Jur, Jurassic; Tri, Triassic; Perm, Permian; Penn, Pennsylvanian; U. Miss, Upper Mississippian; L. Miss, Lower Mississippian; Devo, Devonian; Sil, Silurian; Ord, Ordovician; Cam, Cambrian.

[2] Barrels of oil per day (24 hour rate), flowing (F), pumping (P), swabbing (Sw), or bailing (B); or million cubic feet of gas daily open flow capacity; size of choke given in inches.

the Make-up

Electric Weld Casing



TONGS UP TIGHT . . . in just 1½ turns

● In this fast 906 foot-an-hour casing run, an average of only 1½ to 2 turns was required for tonging-up. Performance like this really cuts your time spent in running casing . . . saves plenty of man-hours . . . gives you more time for makin' hole.

But, that's not all! Republic Electric Weld Casing is made from high ductility steel, fully normalized for uniform structure and cold sized for high yield strength. Walls are uniformly thick and uniformly round. They offer top protection against the dangers of collapse.

For every job where you can't afford to stall—and where you want high resistance to pull-outs and collapse—remember to specify Republic Electric Weld Casing and Tubing.

REPUBLIC *Electric Weld*

REPUBLIC STEEL

NORMALIZED CASING AND TUBING

Other Republic Products include Line Pipe—Carbon, Alloy and Stainless Steels—Upson Studs, Bolts and Nuts—Electrunite Heat Exchanger Tubes

New Oil, Distillate and Gas Fields and New Pay Horizons Discovered in the United States in July, 1950

Also Important Extensions to Established Fields

COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Production Method and Choke	Gravity of Oil
		OKLAHOMA—Oil Field Extensions						
Creek	Slick, S.	H&M Development Corp's Fisher 1, SW SW NW 31-15n-10e. ½ mi ext.	7-13-50	3424	2210- 2220	Red Fork sd;. Penn.	P 8	38
Grant	Lamont, NE.	Kingwood's Glenn Morrill 1, NE SW NW 22-26n-3w. ½ mi extension.	7-13-50	4936	4870- 4887	Mississippi li; Miss.	P 17; 25 wtr.	
Kingfisher	Edmond, W.	Anderson-Prichard's Dickerson 1, C SE NW 26-15n-5w. ½ mi w ext.	7- 8-50	6765	6713- 6735	Bartlesville sd; Penn.	F 152; 5/32"	
		OKLAHOMA—New Distillate Field						
Stephens		Fleet Drlg. & No. American Prod. Co's McPhail 1, SE NW NW 7-2s-6w.	7-20-50	4408	3740- 3771	Pennsylvanian sd; Penn.	F 13; 9.5 mln; 1"	64.6
		OKLAHOMA—New Distillate Pay						
Cleveland	Newcastle,SE	Producers Development Co's Price 1 (OWDD), C NE SE 17-9n-3w.	7-10-50	9498	9292- 9321	Dolomite; Ord.	F 50; 1/8"	50
		TEXAS—District 1 (SOUTH CENTRAL)—New Oil Field						
Bexar		Lee & Hardcastle's M. Penaniezk 1, J. Martinez Sur 14. 5 mi e San Antonio	7-22-50	1620	1558- 1620		P 25	38
		TEXAS—District 2 (MIDDLE GULF)—New Oil Pays						
Goliad	Berclair	Kirkwood & Morgan, Inc's B&C Wilkinson 1, W. P. Miller Sur.	6-28-50	3173	3169- 3171	Vicksburg sd; Olig.	F 31; 8/64"	22.6
Goliad	Berclair	Kirkwood & Morgan, Inc's B&C Wilkinson 2, W. P. Miller Sur.	7-13-50	3236	2814- 2820	Frio sd; Olig.	F 60; 1/2"	21.7
Lavaca	Hulletsville	Stanolind's Roeber Unit 1 (OWWO), Jas. Campbell Sur. 2.	7- 3-50	8486	8408- 8414	L. Wilcox sd; Eoc.	F 128; 1/8"	37
Victoria	Heyser	Gulf's T. P. Traylor 57-B, Jose Esteben Sur.	4-24-50	8000	6142- 6153		F 152; 11/64"	42
		TEXAS—District 2 (MIDDLE GULF)—Gas Field Extension						
Bee	Heard	Fred W. Shield's Mrs. Georgia Heard 1, Michael, Martin & J. O'Toole Sur. 1½ mi nw extension.	7-12-50	4800	3304-3310 4796- 4799		43.5 mln; open 12.5 mln; open	
		TEXAS—District 3 (UPPER GULF)—New Oil Fields						
Austin	Millheim	G. S. Hammond's Walter Schneider 1, Jas. Cummings Sur. 5 mi ne Cat Springs.	7-25-50	11062	10062- 10077		F 135; 1/4"	42.3
Fayette	"Arnim, E".	Continental's Georgia Jones 1, J. S. Menefee Sur. 10 mi nw Flatonia.	7-21-50	2172	2151- 2172	Arnim sd; Eoc.	P 24	20.2
Fayette		Continental's Alfred F. Stinehauser 1, Almon Weaver Sur. 5 mi n Flatonia	7- 7-50	2326	2317- 2326	Arnim sd; Eoc.	P 66	21.2
San Jacinto		G. S. Hammonds' Sue Hill 1, Vitol Flores Lge., 10 mi sw Cold Springs.	5-26-50	4396	4381- 4387		F 4; 1/8"	43
Wharton		Commercial Pet. & Trans. Co's John Kulcak 1, ETRR Sur. 3 mi se Hillje.	7-23-50	6796	6562- 6568		F 172; 1/8"	41
		TEXAS—District 3 (UPPER GULF)—New Oil Pays						
Brazoria	W. Columbia, New	The Texas Co's Phillips 28 (OWWO), Geo. Tennille Sur.	7-13-50	7784	6722- 6730	Deep Frio-7 sd; Olig.	F 214; 1/8"	28.0
Colorado	Sheridan	Shell's Plow Realty Co. 18, Francis Mayhar Sur.	7-14-50	5180	5160- 5168	Yegua sd; Eoc.	F 126; 1/8"	43.5
Harris	Goose Creek	Cullen & Thompson Prod. Co's Am. Legion Post 323-1, Harvey Whiting Sur.	7-31-50	4605	4352- 4364		F 97; 1/8"	21
		TEXAS—District 3 (UPPER GULF)—Oil Field Extension						
Wharton	Prasifka	W. G. Dorsey, Jr's Royal G. Bouscher 1, John McCroskey Sur 2, ½ mi n extension.	7- 3-50	5528	5510- 5524	Frio sd; Olig.	F 91; 7/64"	25.4
		TEXAS—District 3 (UPPER GULF)—New Distillate Fields						
Hardin		L. M. Josey's F. C. & L. R. Eason 1, Blk 12, J. J. Allums Sur.	6-21-50	8550	7132- 7156		F 35; 1.8 mln; 7/32"	58.6
Jefferson		Meredith-Clegg & Hunt et al's Earl C. Hankamer et al Unit 1, Sect. 136, T&NO Sur. 1 mi sw Hamshire.	7-14-50	12809	12607-12670		F 50; 125 mln; open	51.6
Montgomery		Superior's L. N. Kramer et al 1, Edward Taylor Sur. 2 mi se Magnolia.	7-21-50	11377	10896-10915		F 25; 0 7 mln, 3/4"	47.8
		TEXAS—District 3 (UPPER GULF)—Distillate Field Extension						
Brazoria	Un-named	H. L. Hunt et al's City of Alvin Gas Unit 1, HT&B RR Sur. 449. 1 mi ext.	7- 6-50	10602	10473-10482		F 180; 72 mln, open	65
		TEXAS—District 3 (UPPER GULF)—New Gas Pay						
Chambers	Oyster Bayou	Sun's Felix Jackson 31, T&NO Sur.	7-17-50	10200	8408- 8421		38 mln; open	
		TEXAS—District 4 (LOWER GULF-S.W.)—New Oil Fields						
Jim Hogg	"Cunningham"	Pontiac Refg. Co's Roy Yeager 1, W. R. Newman Sur. 5½ mi w Hebbronville.	6-14-50	3207	3079- 3099		P 6	37.5
Jim Hogg	"El Mesquite, S."	Killam & Hurd, Inc's C. W. Hellen 2, Duval Co. Lds Sur 150. 3½ mi wnw Hebbronville.	7-18-50	3069	3064- 3069		P 69	38.5
		TEXAS—District 4 (LOWER GULF-S.W.)—New Oil Pay						
Kleberg	Seeligson	Humble's King Reh-Seeligson 137-C, Alice G. King Sur.	7- 9-50	5735	4850- 4854	Frio (12-B) sd;; Olig.	F 94; 8/64"	43.5
		TEXAS—District 4 (LOWER GULF-S.W.)—New Gas Field						
Nueces		Phillips' Mrs. Elena S. Kenedy et al 1, P. Hinojosa Sur. 8 mi nw Corpus Christie.	7-10-50	9010	6198- 7202		3 mln; 1/4"	
		TEXAS—District 5 (EAST CENTRAL)—New Gas Field						
Limestone		Great Expectations Oil Corp's J. P. Key 1, Rozelia Scott Sur. 4 mi w Mexia	7-29-50	2987	2727- 2740	Woodbine sd; U. Cre.	F 30 mln; open	
		TEXAS—District 6 (NORTHEAST)—New Distillate Field						
Smith	Bobby Jo	Bobby Manziel's John L. Campbell 1, R. Fletcher Sur. 2 mi s Tyler.	5-26-50	8001	7662- 7672	Paluxy sd; L. Cre.	F 530; 20 mln, open	
		TEXAS—District 7-C (WEST CENTRAL)—New Oil Fields						
Coke		Union Oil Co's Daisy McCutcheon 1-B, Sect. 445, Blk 1-A, H&TC Sur. 5 mi e Robert Lee.	7-17-50	6685	3952- 3965	U. Cisco sd; Penn.	F 179; 1/4"	42.6
Crockett		C. A. Hurst & Jack Holt's C. J. Fuller Est. 2, Sect. 4 Blk A-3, D Savage Sur. 2½ mi ne Vaughn fld.	7- 9-50	1246	1232- 1246	San Andres li; Perm.	P 21	34
Kimble		J. K. Davis et al's Mrs. W. Faulkner 1, Sect. 79, Blk A, GWT&P Sur.	7- 4-50	2922	2904- 2914	Strawn sd; Penn.	P 194	29.8
Runnels		G. B. Cree's O. C. Sykes 1, Sect. 6, H. Lewis Sur. 5½ mi sw Aldridge fld.	7-28-50	3894	3874- 3894	Gardner sd; Penn.	F 330; 24/64"	42
Runnels		O. W. Killam's W. W. Early 1, Sect. 346, BBB&C Sur. 7 mi se Winters.	7-17-50	4075	3979- 3990	Gray sd; Perm.	F 235; 1/4"	40
Runnels		Saxon Expl. Co's Jas. Roberts 1, Robertson & Pierce Sur. 2 mi nw Talpa.	7-19-50	3600	2019- 2029	Surratt sd; Penn.	P 102	42
		TEXAS—District 7-C (WEST CENTRAL)—New Oil Pay						
Reagan	Big Lake	Stanolind's Univ. 1-BL, SW¼ Sect. 1, Blk 2, Univ. Lds. Sur.	7-29-50	8940	8879- 8940	Fusselman li; Sil.	F 257; 3/16"	48.6
		TEXAS—District 8 (WEST)—New Oil Fields						
Borden		Rutherford-Heep Oil Co's Jno. Gilmer Davis 1, Sect. 68, Blk 25, H&TC Sur. 2½ mi sw Von Roeder fld.	7-17-50	6781	6729- 6781	Canyon Reef li; Penn.	F 226; 3/16"	42.1
Garza		H. F. Pettigrew & Star Oil Co's O. S. Ranch 1, Sect. 84, Blk 5 GH&HRR Sur.	7-20-50	3155	3046- 3155	Permian li; Perm.	P 25; 31 wtr.	35.2
Howard		George R. Brown's Lloyd Brannon et al 1, Sect. 18, Blk 27, H&TC Sur. 1¾ mi s Vealmoor, E. fld.	7-16-50	7386	7325- 7386	Canyon Reef li; Penn.	F 1212; 3/8"	45
Terry		Anderson-Prichard's H. C. Bevers 1, Sect. 39, Blk DD, John H. Gibson Sur. 3 mi se Wellman.	7-12-50	9811	9712- 9805	Canyon Reef li; Penn.	F 2280; 1"	42.5
Yoakum		Cabot Carbon Co's Bessie Clay 1, (OWDD), Sect. 12, Blk D, H. J. Gibson Sur. 4 mi ne Tokio.	7-18-50	6761	6635- 6725	Clear Fork li; Perm.	P 140	28
		TEXAS—District 8 (WEST)—New Oil Pays						
Ector	Goldsmith	Amcan Oil Corp's B. H. Blakney 1-D, SE¼ Sect. 14, Blk A, PSL Sur.	7- 5-50	6270	6150- 6200	L. Clearfork sd; Perm.	F 360; 1/4"	40.9
Howard	Vealmoor, E.	Sunray's W. L. Wilson 3, Sect. 16, Blk 37, H&TC Sur.	7-16-50	7476	6910- 6960	Wolfcamp li; Perm.	F 745; 8/32"	39.7
		TEXAS—District 8 (WEST)—Oil Field Extensions						
Crane	C-Bar	J. B. Collier et al's W. E. Connell Est. 2-B, Sect. 23, Blk B-22, PSL Sur. 1½ mi ne extension.	7-24-50	3628	3580- 3614	San Andres li; Perm.	P 158	33
Garza	Rocker "A"	R. S. & P. W. Anderson's Stanolind-Stoker 1, Sect. 938, Blk 97, H&TC Sur. 1½ mi ne extension.	7-22-50	2530	2469- 2502	San Andres li; Perm.	P 15; 32 wtr.	37
Scurry	Early Strawn	Herman Brown's G. E. Parks 1, W½ Sect. 442, Blk 97, H&TC Sur. ½ mi s extension.	7-11-50	7478	7292- 7311	Strawn li; Penn.	P 175	38.5
		WYOMING—New Oil Fields						
Converse	Glenrock, S.	Far West & Hancock Oil Co's State 7-1, SW SW SE 7-33n-75w. 2 mi s Glenrock fld.	7-24-50	5880	5856- 5880	Dakota sd; U. Cre.	F 192	36.6
Natrona		Amerada's Unit 6, C SW NE 35-38n-78w. 5 mi fr Sage Spring Creek.	7-25-50	5717	5663- 5672	Dakota sd; U. Cre.	F 150; 11/64"	36.1
		WYOMING—Oil Field Extension						
Niobara	Little Buck	Continental's ELCU-B 18, SW SW NE 35-36n-64w. ½ mi s extension.	7- 3-50	3985	3922- 3948	Dakota sd; U. Cre.	F 600; 1/2"	42

[1] Character of producing formations abbreviated thus: ch, chalk; dolo, dolomite; li, limestone; sd, sandstone; sh, shale; ser, serpentine; cgl, conglomerate. Ages of formation abbreviated thus: Plio, Pliocene; Mio, Miocene; Olig, Oligocene; Eoc, Eocene; U. Cre, Upper Cretaceous; L. Cre, Lower Cretaceous; Jur, Jurassic; Tri, Triassic; Perm, Permian; Penn, Pennsylvanian; U. Miss, Upper Mississippian; L. Miss, Lower Mississippian; Devo, Devonian; Sil, Silurian; Ord, Ordovician; Cam, Cambrian.

[2] Barrels of oil per day (24 hour rate), flowing (F), pumping (P), swabbing (Sw), or bailing (B); or million cubic feet of gas daily open flow capacity; size of choke given in inches.

Drilling Practices In the Permian Basin

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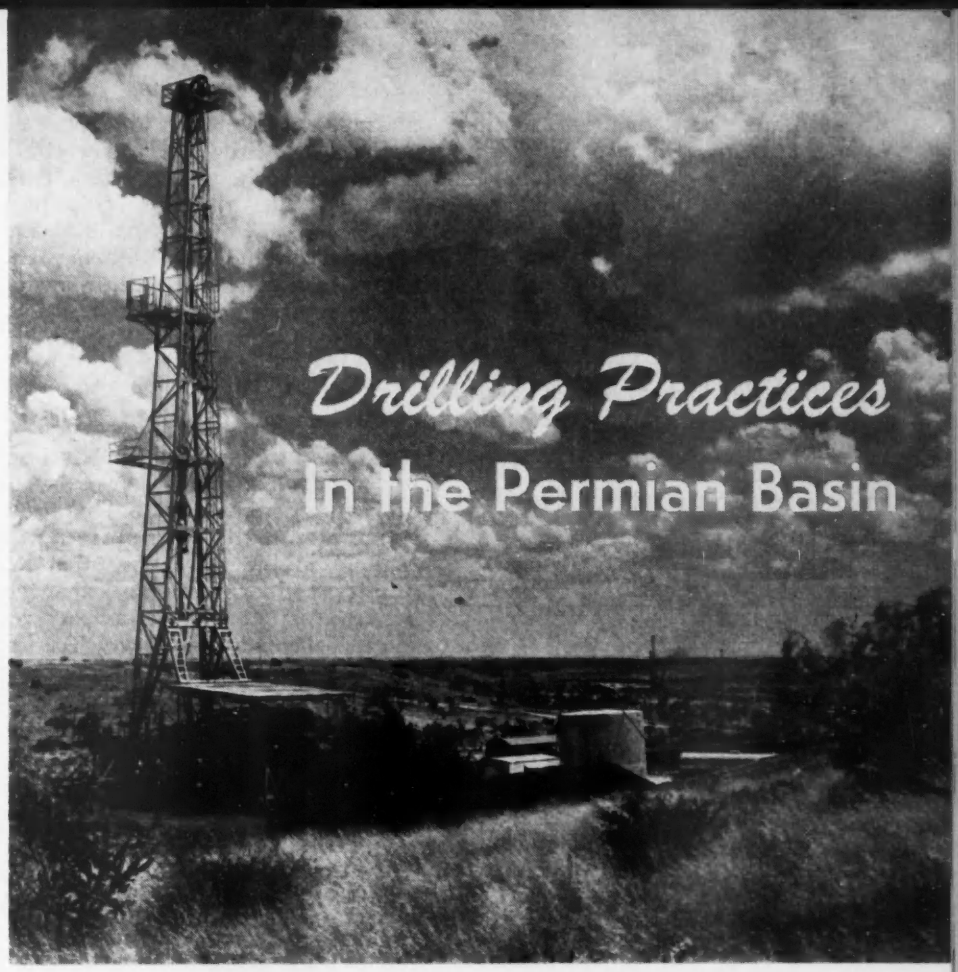

FIGURE 1. The medium-size, 5000- to 8000-foot capacity rig of the type pictured above is in great demand in the Permian Basin area. Exploration and development work in the prolific reef areas accounts for the bulk of this demand. View was taken in the Cogdell area of Scurry County.

DRILLING PROBLEMS fall in the limiting range of some types of jackknife rigs which require special handling to make hole to the deep-lying productive zones. Maintaining straight hole and drilling to gauge have brought in a type of bit follower in which radial clearance is reduced to a minimum, with diamond drilling for hole as well as taking cores finding wide acceptance.

IN THE Permian Basin area of West Texas and New Mexico, currently the most active in the nation, demand for drilling rigs has reached an all-time high in recent months. Much of this demand, of course, is created by the continued high rate of exploration for and development of the prolific reef areas on the eastern side of the Basin. However, activity also has been mounting at a rapid rate in almost every other part of the basin.

With this great amount of drilling activity going on in the area, it might be well to examine trends that have developed recently in rig requirements, new types of equipment that have been developed, and some of the problems that have marked the progress of the drilling industry in this region during the past two or three years.

The most recent trend in demand has principally been for rigs in the range of 5000- to 8000-foot drilling for exploration and development of the reef-type structures in practically all parts of the Permian Basin.

The range of from 5000 to 8000 feet requires 2 sizes of rigs. The smaller rig, which can efficiently operate from 5000 to 7000 feet, would be a rig which would have engine capacity of approximately 500 horsepower. This rig could drill the 12¼- and 8¾-inch hole pattern commonly required for setting 9⅝- and 7-inch casing for the oil string. This same rig is being utilized for making the 11-inch and 6¾-inch hole pattern in which 8⅝- and 5½-inch casing can be set to approximately 7000 feet.

In other parts of the basin, such as Borden County, where the reef is encountered at approximately 7500 feet, a larger rig with approximately 700 horsepower is required. With this size rig (Figure 1) 12¼- and 8¾-inch to 8000 feet wherein 8⅝-inch 9⅝- and 7-inch casing. The same rig also can be utilized in making the smaller hole pattern, 11-inch and 6¾-inch to 8000 feet wherein 8⅝-inch and 5½-inch casing can be set to the reef formation at a depth of approximately 8000 feet.

A large demand also exists for rigs with a capacity of 1000 to 1200 horsepower for drilling to the Ellenburger in the deep areas of the Permian Basin, such as Upton, Midland, Martin, Dawson, and Terry counties, as well as in some of the deep areas of eastern New Mexico. These rigs generally are powered with 3 or 4 engines each of from 350 to 400 horsepower.

Mast-Type Rigs Common

While many of the surface equipment problems have been met quite successfully by the use of sound mechanical engineering judgment, many subsurface problems still exist in the work of boring deep holes in this area. It is of course essential that efforts be made to reduce the hazard and time required to drill, for the reason that so many of the costs of operating rigs are definitely tied up with the time factor. It is estimated that as much as 60 percent, (40 percent labor, 10 percent depreciation, 10 percent taxes, insurance, overhead), of the cost of operating a drilling rig is definitely related to time. To reduce this time much has been done in the reef areas. Practically all rigs of the 5000- to 8000-foot class now uti-

lize drilling masts for the reason that they can be moved more quickly and with less tear-down of equipment than those with the conventional derrick. Much study has been given in the area to unitizing the machinery so it can be moved in larger packages and with less dismantling.

The advancements that have been made on the equipment of the medium-sized rigs have also been carried through on the large rigs except that the use of the mast is not common to such a great extent since the larger rigs generally are subjected to fewer moves per year.

Many problems still exist in West Texas drilling and some of the remedies that have been attempted are herewith discussed.

With the growing use of long strings of drill collars it has been found that bit life has been materially reduced, in hours, although the amount of footage secured is greater than was obtained with a lighter weight string. Under this technique it has been necessary, however, to try to determine when the bit is ready to be pulled by means other than simply noting the decreasing rate of penetration. With the use of increased weight carried on the bit, it is necessary that particular attention be paid to the condition of the bit, for bearing failures are more likely to occur when the bit is worn. A simple and practical way to determine when bit bearings are beginning to deteriorate is simply to throw the rotary clutch out and note how much back twist there is in the drill pipe. If the back twist exceeds 2 or 3 turns in a deep hole it is certain that the bearings and the bit have started to wear, allowing the cones to skew and so cause an undue torque to be built up in the drill pipe.

Maintaining Straight Holes

Another problem which has been prevalent in the area has been that of preventing crooked holes. This problem is generally associated with changes in the formations that are penetrated or when an extremely hard formation, such as a fractured chert, is encountered and which causes the bit to drill off the vertical. In the Permian Basin area some success has been attained in keeping holes straight by the use of oversize drill collars; the diameter being large with respect to hole diameter. For many years, it has been quite common to use 6¼- and 6½-inch drill collars in 8¾-inch hole. Similarly, the common collar for 6¾-inch hole was the 5¼-inch drill collar. These collars, however, were relatively limber, and some operators began to use a limited number of 8-inch collars in 8¾-inch hole. They also have resorted to the use of a few 6¼-inch outside diameter collars in 6¾-inch hole. This practice has aided materially in keeping the hole straight and the practice is growing.

FIGURE 2. This tool, run in directly above the bit, materially assists in keeping a straight hole. The tool illustrated has a maximum outside diameter of 8⅝ inches, is 10 feet long, and is intended to be run in 8¾-inch hole. Ribs are ⅜-inch thick by 2 inches wide and are dressed with tungsten carbide. Ribs in each of the two 3-foot ribbed sections are staggered so one set always is against the wall of the hole.

In some cases, on structures where extremely steep dips are encountered, it has been found that while the large collars help, they do not necessarily eliminate the crooked hole problem. Recently 2 new stabilizers have been introduced which give some promise of helping to solve this problem. One of these stabilizers consists of a cylindrical tube or sleeve mounted on a body which has a drill collar connection on one end, and a box connection on the other which engages the drilling bit. The sleeve can rotate on the body and also can move axially, so that in the event the tool becomes stuck, some jarring motion can be obtained between the body and the sleeve. The sleeve has an external diameter of 8½ inches and a length of 6 to 7 feet. The amount of jarring space is approximately 20 inches. This particular tool is intended for use in an 8¾-inch hole.

Another tool which recently has been tried is simply an enlarged drill collar with wide ribs and relatively shallow fluid passages or flutes. The theory behind use of this tool (Figure 2) is that it is extremely rigid and that by using the wide fins the cuttings from the bit will pack behind the ribs and so stabilize the tool in the hole. The outside diameter of the ribs on this tool is made 8⅝ inches when it is to be run in 8¾-inch hole and 6⅝ inches in diameter when run in 6¾-inch hole. It is felt that this tool not only assists in maintaining a straight hole but eliminates the need for reaming the hole and also appears to contribute to longer bit life. The reason that longer bit life can be experienced probably is due to the fact that lateral motion of the bit is reduced, which in turn reduces the end thrust on the cones of the bit.

Chert Drilling Speeded

In view of these and other efforts that have been directed toward drilling straighter holes, considerably better time is now possible in drilling through chert sections. In the past,

the trouble always seemed to be that the hole would go off vertical and soon would exceed the limits set by the operating companies. With the means now available to keep the hole straight, much better drilling time in chert is possible. For example, it is not uncommon to drill chert at rates of 35 or 40 feet per day where, in the past, 3 or 4 feet per day was considered good time.

It has long been realized that progress toward more economical drilling would have to come about partly through bits which would stay on bottom and drill for longer periods of time. It has been noted that in bits used in oil-emulsion muds as well as when drilling-in with oil that bearing life of the bits was considerably improved. In view of the fact that bits often are pulled because bearing failure is feared, one manufacturer is experimenting with a lubricated rock bit. It is hoped that by feeding lubrication to the roller bearings in the bit that a material increase in the life of the bit will be secured. Preliminary tests made so far are encouraging and plans are progressing on further tests to determine whether the lubricated rock bit again can be reduced to a practical tool.

Automatic Feed Controls

Another tool which is receiving much consideration, particularly on the larger rigs, is the automatic feed control. Numerous hydraulic feed control units now are in use in this area. Another feedoff device which recently has been placed in service is shown in Figure 3. This unit consists principally of a speed increaser and a hydraulic motor which can be used as a retarder or as a driving motor, depending upon the signal received from the control equipment. A pilot valve is used to regulate the pressure in the diaphragm unit which, in turn, is attached to the deadline. When the pressure builds up in the diaphragm unit for the reason that the bit is drilling off, air is permitted to flow from the pilot valve to the diaphragm motor valve, with the result that the diaphragm motor valve opens.

The hydraulic circuit is as follows: oil is taken from the oil reservoir tank through the suction screen and is then drawn through the supercharge pump which in turn delivers it to a pressure valve, the latter holding a pressure of approximately 75 pounds on the hydraulic motor. When the diaphragm motor valve opens, oil from the hydraulic motor passes through this valve returns to the oil tank. With the passage of the oil the hydraulic motor turns and rotates the drum which allows the drilling line to feed off of the drum. When the diaphragm motor valve closes, the flow of oil through the hydraulic motor stops and accordingly the feedoff of the drum also stops. Under these conditions the pressure between the hydraulic motor discharge and the diaphragm motor valve builds up to between 200 and 300 pounds, depending on the load being supported by the hook.

As a safety device, a relay is connected to the discharge line from the hydraulic motor to the diaphragm motor valve. This relay opens when the pressure in this line drops to 100 pounds, allowing air to pass through the relay and into the emergency cylin-

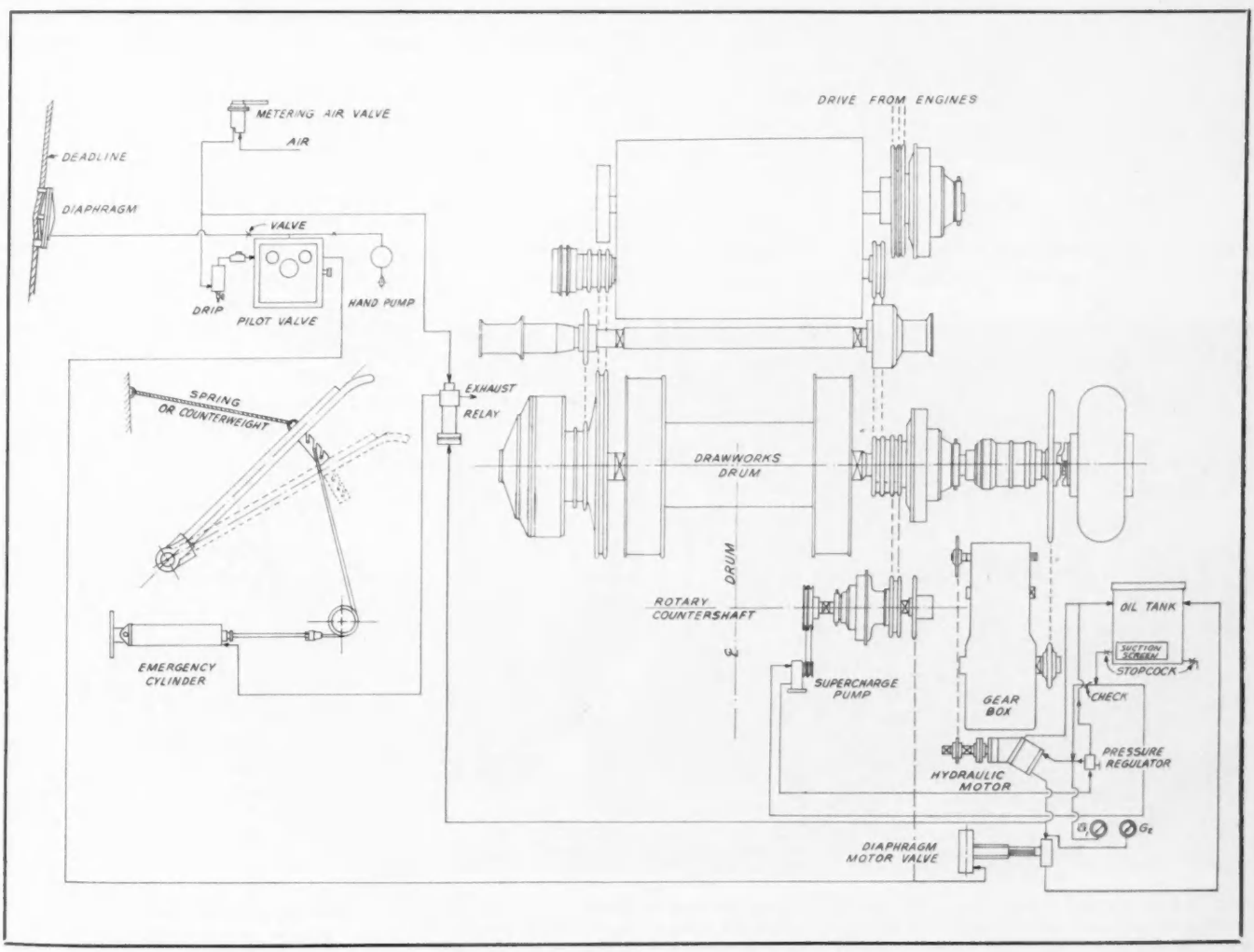

FIGURE 3

der which in turn sets the hand control brake. It is evident that the pressure in the discharge line of the hydraulic motor can drop only when a chain breaks or a clutch disengages on the drum shaft of the feed-off unit.

It is felt that the use of this unit, shown installed on a rig (Figure 4), not only has reduced drilling time by about 10 percent, but that it also has resulted in a 10 to 15 percent saving in the number of bits consumed. Constant feed has resulted in helping keep the hole straight.

Diamond Bits

Another development of considerable importance in the Permian Basin has been the increased use; particularly during the past 6 to 12 months, of diamond bits. This bit is being used with considerable success not only in coring, but in making hole in extremely hard chert and quartzitic formations. Diamond drilling also is solving certain drilling problems such as milling out of casing, whipstocking new hole, washing over stuck pipe, and straightening crooked hole.

Among the advantages realized through the use of this type of bit are (1) unusually high core recovery, averaging close to 100 percent; (2) ability to drill full hole while coring, eliminating the need to ream after the section is cored; (3) ability to use lower pump pressures, thus reducing lost circulation or mudding-off of the pay zone; (4) ability to make more hole in tough formations per round trip of the drill pipe; and (5) its tendency to deviate less when normal weight is carried on the bit.

Diamond bits are being used to an increasingly greater extent, especially in the coring of pay sections. One drilling company, for example, uses diamond core head bits in about 90 percent of its coring work. Good results are being obtained not only in the deep (10,000 to 14,000 feet) Ellenburger drilling, but in shallower wells, including the reef formations in the eastern part of the basin.

Considerable improvement has been made during the past year in not only the bits themselves, but in the over-all general design of barrels and the techniques used in running the equipment. Prices now are lower and, considering the salvage value of diamonds when bits are worn, the per-foot cost of diamond coring is much lower than when diamond bits came into general use a few years ago. Contributing to the increased use and success of diamond bits in the basin is the practice of some drilling companies to take advantage of services offered by bit companies who not only sell the bits, but also supply an engineer who stays on the well to make certain that they are run properly, are used in the correct manner, that correct weight is carried on the bit, and generally see that the driller obtains maximum footage from the bits.

Personnel Training Programs

With all the technical improvements that have been made, it is conceded that none would be very effective unless members of the operating personnel are properly trained to utilize these tools and devices for the maximum benefit of both the operator and contractor. To handle this training, some of the contractors in the basin are resorting to the conference system of training. This training work is being carried on by trained specialists. The American Association of Oilwell Drilling Contractors, in conjunction with the Division of Extension, University of Texas, has entered into the Employer Unit Plan of Supervisory Training.

The 15 or more participating drilling contractors in the Permian Basin are making an effort to improve efficiency by means of this educational approach. This program begins with top management. Every step is planned with management and all levels of management actively participate in the program. The training technique is basically predicated upon use of the conference method of teaching. One member of top management conducts a continuous series of conferences, each carefully planned in advance. These conferences enable management to obtain the reactions of employes before decisions are made. Decisions, where feasible, are made at the lowest competent level. The discussions induce all employes to share information with others. Problems are discussed from the employe point of view. Good ideas come from crew members who have worked for many different companies.

Some of the common problems discussed are accident prevention, operating procedures, equipment maintenance, rig inspections, and accident investigation. Minutes of all meetings are kept, reproduced, and distributed to all participants. The meetings serve to make known and to insure uniform interpretation of policy, and to keep the office in direct contact with all crews. Harmony results from democratically formulated policies, which naturally are more enthusiastically adopted when all employes share in the making of such policies. The rewards in attitude cause the training program to become ingrained in the day-to-day activities of the organization.

The training program has as its ultimate goal the development of highly trained key personnel with an organizational consciousness and attitude. This directly affects the time factor of drilling holes as well as accident prevention, turnover, and customer relations. Those firms whose executives realize the possibilities of the program and pursue it with a maximum of energy and interest will make it more successful than others. The greatest return will come to the individual contractor when the training becomes industry-wide.

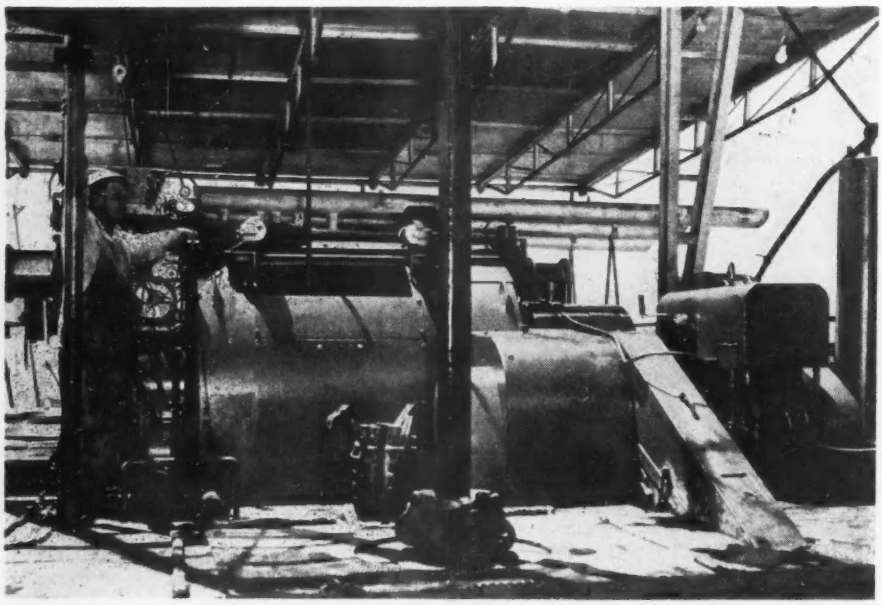

FIGURE 4. In this derrick floor view can be seen the controls and most of the equipment used in a new type of automatic feed-off device. At left above the driller's hand is the control regulator with which the driller sets the weight desired on the bit. Just behind the kelly, under the guard, is the supercharge pump. At the right, above and to the right of the rotary chain drive, is the housed-in speed increaser and hydraulic motor which is geared directly to the drum shaft.

REMEMBER

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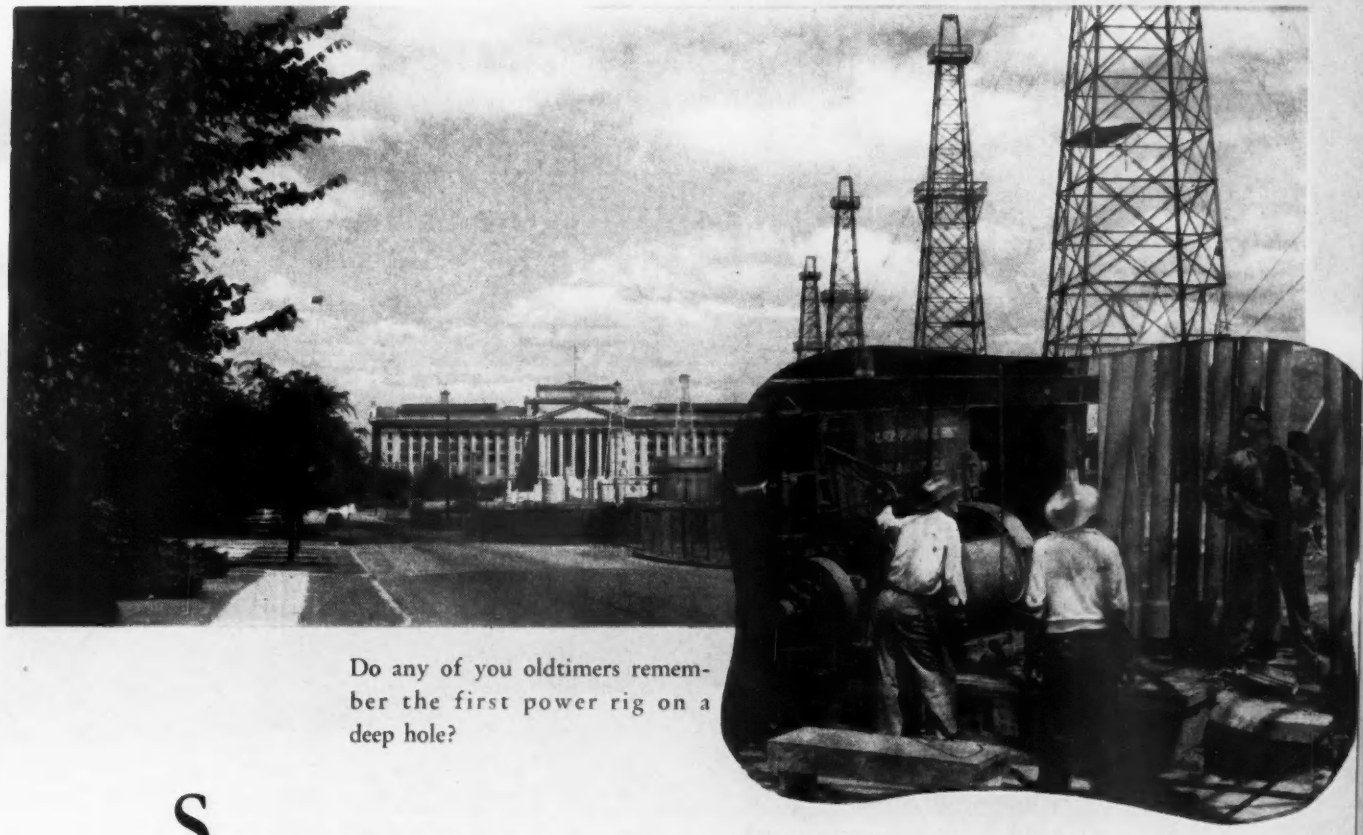

Do any of you oldtimers remember the first power rig on a deep hole?

Sooner Senators stared. Steam supporters scoffed. Oil, Politics, Steam Drilling and Power Rigs got hopelessly mixed. That puny little power rig could never drill so deep. Steam was safe! But Wilson changed all that!

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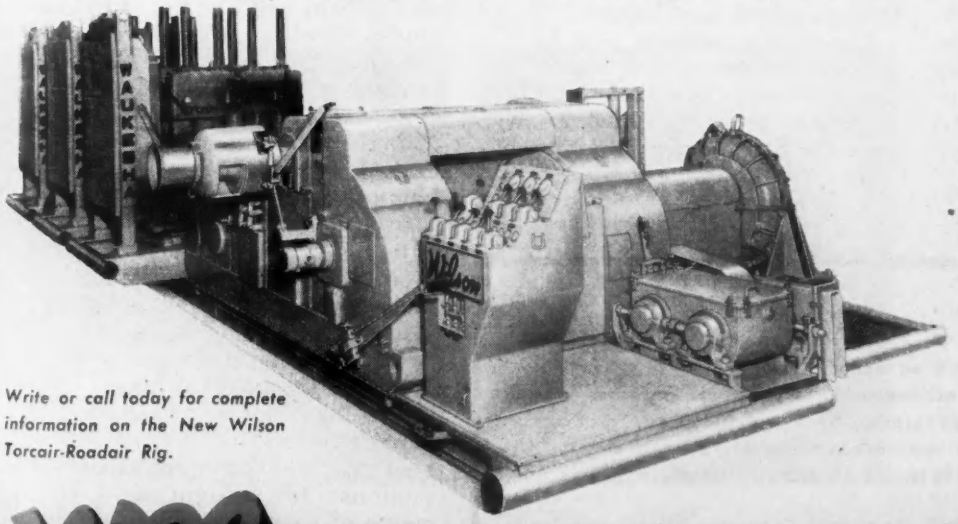
The building in the background is the Oklahoma State Capitol surrounded by many wells which are still producing today. The first power drilling rig in the Oklahoma City Field was the one shown above (inset). It was the beginning of the end for steam in deep drilling.



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Selective acidizing job on a newly-completed West Texas well. Two acid pumpers with tanks for transporting acid and an electric pilot unit are shown on location.

Selective Acidizing In the Permian Basin

By J. E. KASTROP
Gulf Coast District Editor

SELECTIVE ACIDIZING is fast becoming an exacting science and is common procedure in the Permian Basin. It is accounting for widespread increases in well productivity and is adding oil and gas reserves by providing the key to otherwise untapped sources of petroleum. The applications of selective treatment are discussed along with methods employed to isolate productive intervals in the pay zone.

INCREASED oil and gas production through more efficient reservoir drainage has been effected by proper application of selective acidizing techniques in the Permian Basin. The calcareous nature of the thick pay zones and the non-uniformity of permeability make this prolific oil province an ideal locale for selective acidizing. What might have been dry holes or marginal producers have been placed on a commercial basis through selective acidizing.

Use of hydrochloric acid to dissolve limestones and dolomitic formations is not a new art, having been thought of as early as 1896, 37 years after the first commercial oil production in Pennsylvania. Lack of an effective corrosion inhibitor prevented its use until 1932, when Dow Chemical Company and The Pure Oil Company acidized the first oil well in the Greendale field of central Michigan to increase an old producer from 3 to 8 barrels per day.

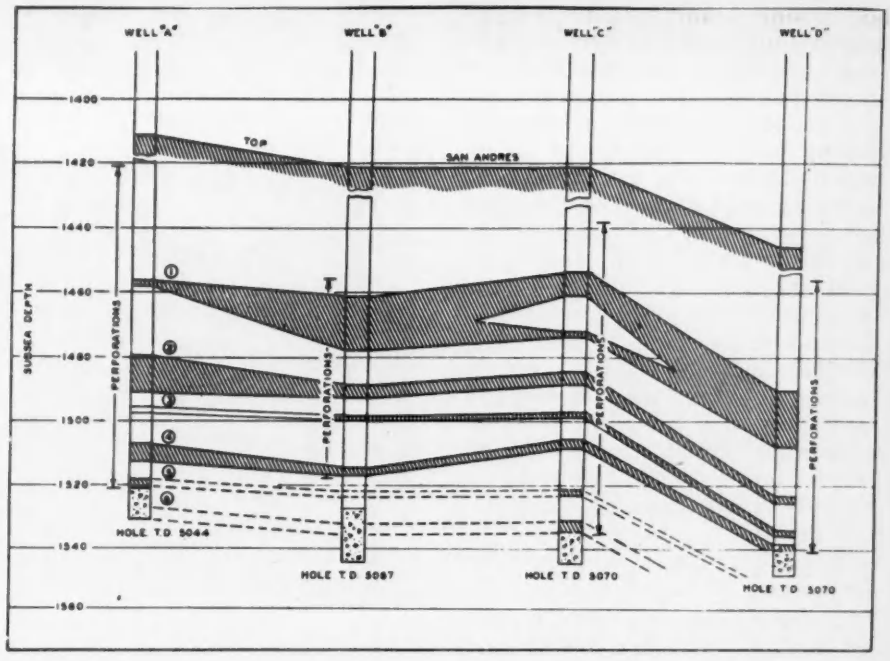
As the application of acidizing increased through the years, it was found that the permeability and porosity of thick limestone and dolomitic reservoirs were erratic. Measurement of these properties in core samples showed alternating high and low values of permeability and porosity. This wide variation in permeability makes it necessary to inject most of the acid in the less permeable streaks while little or no acid reaches the more permeable sections. In straight acid treatments of zones containing sections of both high and low permeability,

and where the entire zone is subjected to the same acid injection pressure, the section of higher permeability will take most of the acid, and little or no benefit will be gained in the less permeable sections where the need is greatest.

Isolating these less permeable zones in the bore hole and injecting desirable quantities of acid is selective acidizing. It is simply an acid treatment in which any tool or technique is used that diverts any or all the acid to some predetermined section in the well bore.

Hundreds of important discoveries have been made in the Permian Basin where completion hinged on identifying and properly treating the pay horizon. In many cases where saturated zones were identified, but lack of permeability precluded commercial production, selective acidizing made the difference between a dry hole and an oil well.

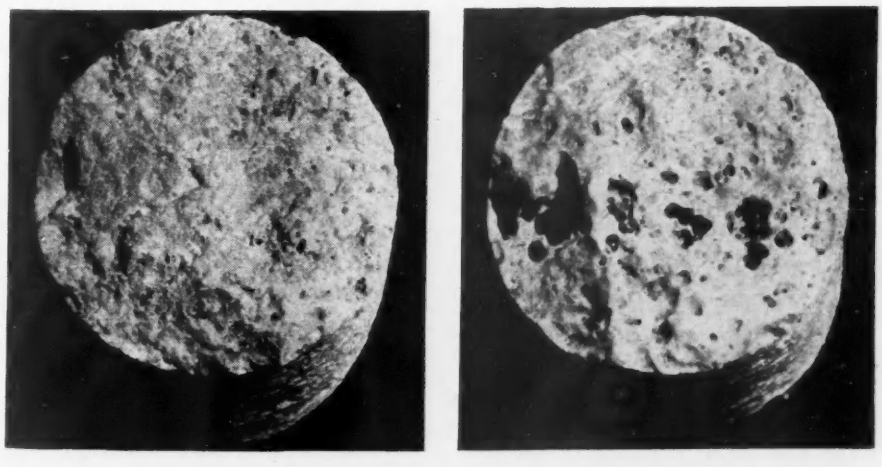
While acidizing has become as common in the Permian Basin as the electric log, a vast backlog of acidizing jobs indicates that in a majority of cases some form of selective acidizing, be it a simple one-stage treatment or a complicated 3-stage, dual zone job, would help increase the productivity factor. It is of equal interest to the well operator, the land owner, and to the economy of the nation that any profitable measure be taken that will increase the productivity of an oil or gas well. Because acidizing, and especially selective acidizing, has done so much to accomplish this end in the Permian Basin, and because selective acidizing may, in certain instances, provide the key to unlock oil and gas reserves, the techniques employed in selective acidizing and some field examples will be described.



Example of variations in permeability through one limestone formation in West Texas (shaded areas indicate permeable sections in the San Andres lime), to illustrate the application of selective acidizing. These wells are located in Hockley County, and are on 1250-foot spacing. Illustration from API paper No. 826-15-H, "Some Recent Advances in Well Treating Methods and Equipment," by P. E. Fitzgerald, Dowell Incorporated.

Selective acidizing has been of considerable aid to the following types of wells:

1. New wells, in which a change in lithology is present in the open hole or behind the perforated casing. Such changes may involve sand, limestone or dolomite.
2. New wells in which saturated zones of varying permeability are present.
3. Wells showing excessive gas-oil ratios but with the possibility of additional available oil present in tighter saturated sections.
4. Wells in which it is desirable to make additional gas available to aid in flowing the well.
5. Wells with intermediate water zones.
6. Wells deepened to new pay zones.
7. Old wells with depleted zones, but with oil remaining to be recovered from the tighter sections.
8. Wells in which it is desirable to hold acid away from a plug-back or other repair work, including drillable liners, plastic or cement squeeze and "redrill" jobs.
9. Wells in which conditions are such that it is important to keep acid away from casing seats or to know if fluid does bypass during the treatment.
10. Injection or pressure maintenance wells in which it is desired to have more uniform distribution of the gas or water being returned to the formation, or in which it is desired to alter existing injection characteristics.



The effect of 100 cubic centimeters of 15 percent hydrochloric acid on a dolomite core taken in the Vealmoor field of Howard County. The core is shown before treatment on the left.

Principal Methods

It is understood that only those formations whose chemical composition make them receptive to acidizing will be treated, and when a careful analysis of all existing well information indicates that the treatment should be selective and at what intervals. The principal methods employed to selectively acidize wells:

1. The 2-pump or casing pump

method, possibly the simplest and earliest method of selective acidizing, utilizes 2 positive displacement pumps. One pump supplies oil to the annulus between the casing and the tubing, or to the tubing, depending upon whether it is desired to hold acid on the lower or upper sections of the pay zone, while the second pump injects the acid through the tubing (or the annulus) and into the selected formation. The acid is spotted by displacement calculations, and the success of this method depends upon the oil holding the interface somewhat static at the desired depth during the injection operation. With this method alone it is not possible to know definitely at what point the acid enters the formation.

2. Application of acid to the face of the formation by jetting with the acid jet gun. While this method applies primarily to open hole completions and is quite effective in removing cement sheaths or other obstructions on the well face, control of the acid is only to the extent of where it impinges upon the open hole, after which control is lost and the acid will enter the formation at the most permeable section.

3. Use of packers to isolate one or more zones to be treated. These packers are run in the well on tubing strings and are expanded inside the casing or against the open hole, as the case may be. Developments in packer construction make their use in a cased hole a relatively simple and safe operation when selectively acidizing through perforated sections. Both hookwall type and anchor type packers have been successful in these cases. Packers have been extremely useful in old wells to protect weak casing from the injection pressures imposed on the tubing string.

The problem of isolating the less permeable intervals in the open hole provides a more complicated problem, since with any type open-hole packer it is necessary to have an impermeable section in which to seat the packer. If there is no impermeable interval on which to seat the packer, there is the danger that the acid will dissolve the formation around the packer and allow the acid to escape even though pressure may be imposed on both sides of the packing element.

Acid and oil lines connected to acid pumpers make it possible to treat with large volumes of acid in more than one stage.

Some success has been experienced in the Permian Basin with a hydraulic-type packer with telescoping inner mandrel in wells where suitable packer settings could be made. Acid is spotted opposite the section to be treated by displacement calculations based on tubing volume while oil is passed through circulating ports in the packer. After the acid is spotted, these circulating ports are closed to isolate the treating zone, and pressure on the tubing forces the acid into the formation.

4. Placing temporary plugs in the bottom of the well has been used to protect the lower section of the open hole from the acid treatment. This method is applicable where the lower interval in the hole may be near the water table and acid treatment would certainly increase water production.

Gravel and sand are normally used as the bulk plugging or filling materials. A plastic cap is placed over the filling material to form an impervious plug, thereby forcing the treatment into the upper zones. The temporary filling seal can easily be drilled out, in some cases with a special bailer.

5. The spotting of temporary plugging agents such as mud or jelly seal usually with some additive solids such as ground plastic over the more permeable sections in order to build up sufficient pressure to break down the less permeable sections to be treated. The clean-out problem and sometimes clogging of flow lines and production equipment make the use of plugging agents somewhat unpopular. It is practically impossible to determine or control the area being treated with acid, since the acid may escape into an unplugged section or through a partially plugged area.

6. Setting temporary bridge plugs which are tamped with gravel and capped with plastic to shut off communication with lower zones where acid treatment is not wanted. The bridge plug is run in the hole on a wire line and the gravel, along with the plastic material placed on top of the plug by means of 5-gallon bailers.

A recent development in temporary bridge plugs utilizes a bailer, on the bottom of which is run the plug. An exploding cap expands a packer element which forms the seal. As the bailer is raised, cement is dumped on the bridge plug to provide a solid seal above which acid treatment can be made.

7. Selective acidizing with the "electric pilot" is an outgrowth of the 2-pump method wherein certain intervals are selected, the pilot lowered to a predetermined depth, and part or all the acid controlled above or below that point.

Aids to Selective Treatments

Several important developments have been made in recent years to

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Brewster-Bartle had previously used an "Oilwell" No. 96 Rig which gave such good performance that they decided to install similar equipment on the barge. They haven't been disappointed. When this advertisement was written, they had drilled to 8,963 feet in 37 days with no trouble from the "Oilwell" equipment.

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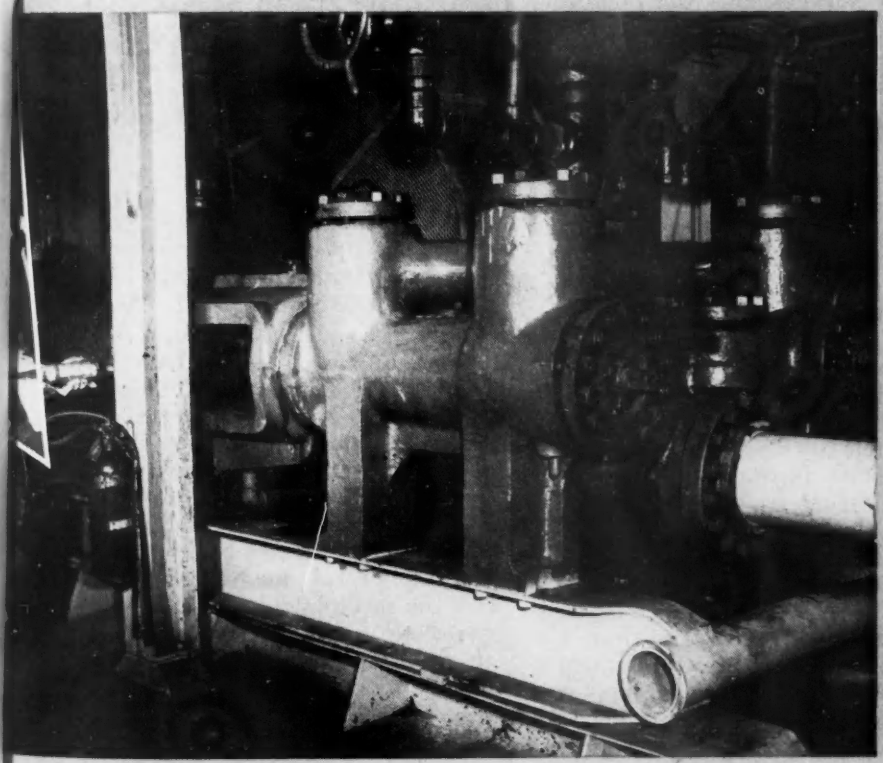

Two "Oilwell" No. 220-P Duplex Power Pumps do a large share of the drilling because of their high pressure and steady operation. They are equipped with DI-HARD Liners for longest possible service without change. A majority of the rigs in this area use "Oilwell" and Wilson-Snyder Pumps because of their outstanding performance.

The New "Oilwell" No. 480 Traveling Block is narrow, compact, streamlined and so well-balanced it will stay vertical even when running light at high speeds.
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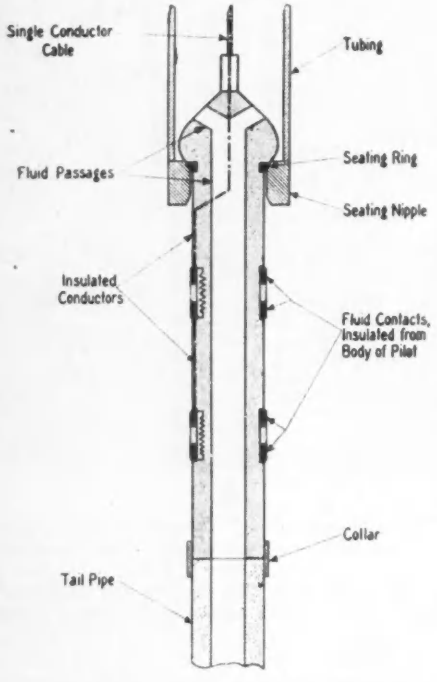
advance the science of selective acidizing. These are tools which provide the operator with more detailed information on reservoir characteristics, and make possible accurate control over the placement of acid in a selected zone.

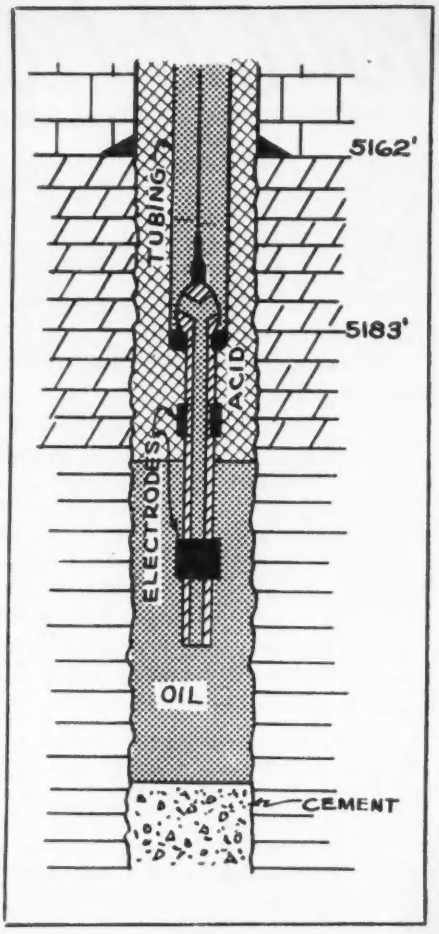
Among the most successful and important tools developed in this field has been the "electric pilot." This device is run in the hole through the tubing on an electric cable to measure the electrical conductivity of fluid surrounding a set of electrodes insulated from one another. The interface between two liquids of dissimilar electrical conductivity can be accurately located and followed. By knowing the position of this interface the acid can be controlled during the injection operation. The electric pilot extends below the bottom joint of tubing. This tool has been successful in selective acidizing by all the methods described above and by combinations of them. A similar tool is useful in making comparative permeability surveys.

A device known as the tubing electrode was developed last year to locate the interface between acid and oil on the outside of the tubing and at any point above the bottom joint. The tool consists of a secondary electrode which resembles a nipple placed in the tubing. The secondary electrode contains 2 brass rings which are the electrodes. A primary electrode is run inside the tubing on electrical cable and is seated within the secondary electrode nipple. It is used to detect the encroachment of acid upon the brass rings on the outside of the tubing nipple comprising the secondary. It is useful in acidizing 2 zones without moving the tubing, or it may be used to check for possible leaks above packers when the latter are used in selective work. When placed in the string above the packer, the tubing electrodes aid in the treatment of 3 separate zones without moving the tubing.

Another tool helpful in measuring the relative injection characteristics from point to point throughout an entire zone is a small propeller-like spinner, it is mounted inside a guard cage and is run in the hole on an electrical cable. While the tool slowly traverses the entire zone, fluid is pumped down the hole and into the formation. The spinner measures directly the relative rates at which fluid is being taken into the formation at different depths. An analysis of spinner surveys aids the operator in selecting those intervals of less permeability and which should be treated.



Schematic diagram of the electric pilot which has been of considerable aid in selective acidizing.



Schematic diagram of 2-pump method in conjunction with the electric pilot.

Field Case Histories

The following field case histories are presented to illustrate a few of the applications of selective acidizing and to demonstrate the various methods described. In many cases found in field practice, a combination of basic methods is employed to bring about the desired treatment. Production rates before and after the selective treatment are presented to show what can be accomplished through proper selective acidizing.

The 2-pump method was successfully used in combination with the electric pilot in a Cowden field well. The operator had encountered high water-oil ratio and low oil production from a 53-foot pay zone. As a solution to the problem, the lower 27 feet of the producing zone was cemented off and it was decided to acidize the upper 21 feet of the zone with 2500 gallons of acid without permitting acid near the bottom-hole cement plug. Two pump trucks and the electric pilot were used.

As a precautionary measure, the hole was circulated with oil to remove any excess water from the lower portion of the hole. The electrode was run through the tubing and seated so that the lower part of the electrode was located near the top of the cement plug. The tubing was bottomed at 5183 feet.

Acid was spotted down the tubing and up into the well annulus until the acid cleared the electrodes and they were covered with oil. The casing pump was started and the acid was forced into the formation above the electrode by means of the acid pump. The acid was kept above the electrodes by means of pumping oil down the tubing with the second acid pump. The oil passed through the electrode and out the bottom just above the cement plug. As a result of this treatment, in addition to the cementing job, the oil production increased immediately from 7 to 50 barrels per day. Water production before the workover job was 50 per cent, and this was successfully shut off.

The use of packers and the advantages of selective acidizing were well demonstrated in a well in the Fullerton field of Andrews County. The pay zone consisted of two producing sections, and it was desired

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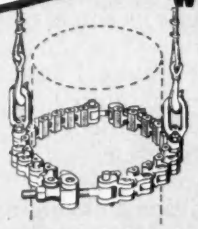
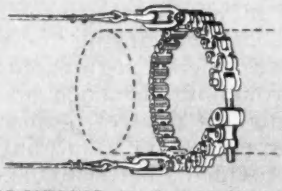


FOR LIFTING casing, pipe, liners or tubing, the Safety Clamp is equipped with lifting ears through which a sling can be fastened to substitute for elevators. The Extra Large Size shown here fits casing up to 21" in diameter!

FOR SNUBBING drill pipe and tubing, the Safety Clamp is simply inverted so the slip segments pull down instead of up. Easily-attached hold-down ears permit fastening anchoring cables with maximum speed and simplicity.



FOR PULLING pipe lines or pipe sections into alignment for welding, coupling or positioning, a Safety Clamp fastened around the pipe provides a slip-proof grip for pulling manually or mechanically.

Get Complete Details on the many ways Baash-Ross Safety Clamps can increase the safety and efficiency of your rig operations. Your local supply dealer will gladly supply full information —or write direct!

There seems to be no limit to the variety of jobs operators have figured out for the Baash-Ross Safety Clamp. Originally designed to take a quick, slip-proof grip on drill collars, liners and other flush joint equipment to prevent it from dropping through the table, it is now available in four sizes—Tubing, Regular, Large and Extra Large—to lift equipment *up* . . . or hold it *down* . . . or pull it *sideways. In fact, wherever you have a job calling for a firm grip on anything cylindrical—from only 1⅛" in diameter to 21"—the Baash-Ross Safety Clamp will probably do the job easier than you ever thought possible!*

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The Safety Clamp consists essentially of many individual links flexibly hinged together. Each link has a tapered slip held in retracted position by a spring. When the Clamp is tightened around the pipe—a quick and simple operation—each slip takes a firm initial grip on the surface of the pipe. As the load increases, each slip is wedged tighter, preventing any slippage between pipe and Clamp. There's no risk of crushing thin-walled pipe or damaging pipe surfaces because the grip is *uniformly distributed around the full circumference.* And since each link is interchangeable as a unit, simply adding or removing links readily adapts the Clamp to virtually any diameter pipe in common use.

Baash-Ross Safety Clamps are available through leading oil field supply dealers.

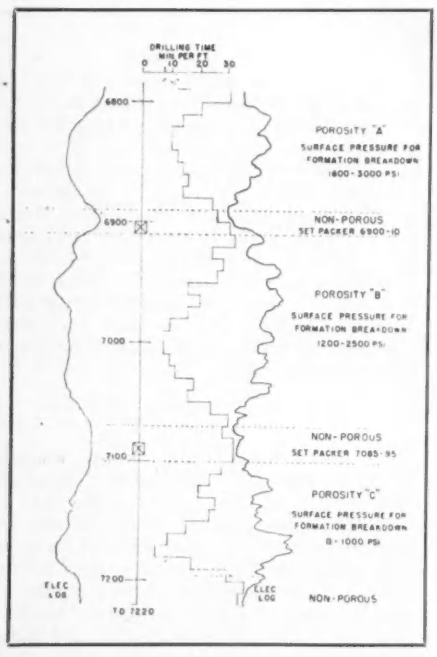
to treat each section separately. A hydraulic packer was set at 6984 feet and a side-door choke placed in the tubing 4 feet above it. The upper section was treated through the choke with the side port open, and the bottom section treated below the packer.

The upper zone was tested and it flowed 52 barrels of oil in 8 hours. It was treated with 2000 gallons of 20 percent acid. The formation broke down with 1700 pounds pressure on the casing and treated at 1375 to 1200 pounds tubing pressure at an injection rate of 1.2 barrels per minute. After the treatment, the upper zone flowed 64 barrels on a 3-hour test.

The choke was changed and the bottom section was tested. After swabbing, it flowed 15 barrels of oil per hour for 4 hours. The bottom section was then treated with 2000 gallons of 20 percent acid. Casing pressure on top of the packer as a precautionary measure varied from 1550 to 1625 pounds. When the formation broke down, tubing pressure was 675 pounds, and the formation treated at 650 pounds, climbing to 900 pounds due to loss of hydrostatic head when flushing with oil. Injection rate was 0.8 barrels per minute.

After the treatment, the well was cleaned and flowed 60 barrels of oil per hour plus 1¼ million cubic feet of gas on a 4-hour test. The bottom section was then re-treated with 6000 gallons of acid 4000 of 20 percent and 2000 of 15 percent). Tubing pressure ranged from 525 to 450 pounds during injection and climbed to 1300 pounds at end of oil flush. Injection rate was 2.0 barrels per minute. The zone was tested at 84 barrels of oil per hour for 4 hours with 1,600,000 cubic feet of gas. On a potential test, the well flowed 745 barrels of oil per day on a 24/64-inch tubing choke with a gas-oil ratio of 871/1.

This well was selected because of the available records on both the natural flow tests in each zone and tests taken after each zone was treated. The difference in treating pressures for each zone is typical of wells in the Fullerton field. It is obvious that had the whole section been treated as one zone, the upper section would have received little, if any, benefit from the acid treatment.

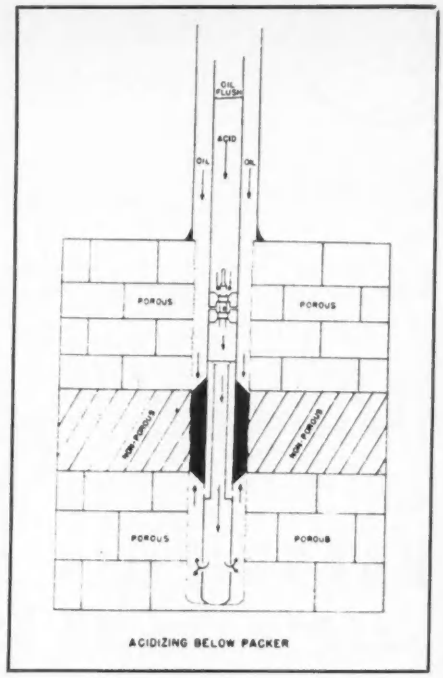


Drilling time records and electric logs are often extremely useful in selecting packer setting points in selective acidizing multiple zones.

Wasson Field Example

One of the outstanding examples of how selective acidizing can increase the productivity of a well may be found in the Wasson field of Yoakum County. On one particular lease, wells were completed during 1938 and 1939 and acidized in three stages. Acid was injected over the entire open section which exposed several different pay intervals. Since the advent of controlled acidizing and the development of adequate tools for selective work, much has been learned about the distribution of acid in these thick open hole sections with several producing horizons.

These early wells were acidized in stages with a total of from 8000 to 9000 gallons over the entire zone. Average potential of these wells was 1034 barrels per day. Last year, 4 new wells were drilled on the same lease, these new wells being inside wells. Pipe was set approximately 150 feet deeper than the previous wells, but the total depth was about the same in both cases. The newer wells were treated with 16,000 gallons of acid with a packer set in the middle of the pay zone and 8000 gallons injected beneath the packer and 8000 gallons injected above the packer. Average potential for the new wells, surrounded by the old wells drilled in 1938-39, was 1790 barrels of oil per day, representing an increase of 756 barrels per day per well over those originally drilled on the same lease 12 years ago. This gain of approximately 73 percent was fairly well distributed among the 4 wells, since each of the 4 had a much better potential than any one of the previous 6 wells. The results cited above are based not on a single well, but on 4 wells which were evenly distributed over the lease among the old wells, and it is considered a fair test of the new way of treating thick sections with acid compared to the old conventional method.



Typical example of the packer method in acidizing above and below an open hole anchor-type packer.

Significant Oil Tool

Increased knowledge of the mechanics of acidizing brought about this highly successful method of selective treatment, and developments are currently being made and tested in this specialized field. Every acidizing job is a special one and differs in some respects from the treatment given on adjacent wells. The many different well conditions encountered in practically every case challenge the ingenuity and thoroughness of the acidizing engineer.

In addition to bringing about increased productivity and thereby uncovering additional oil reserves, selective acidizing has given the reservoir engineer very valuable data on the flow characteristics of a field in which selective work is applicable. The varying breakdown pressures of each segregated interval throughout the open hole, the evaluation of relative permeability streaks, plus other important data, have provided a better understanding of reservoir performance of the complicated limestone and dolomite type fields.

MicroLogging in West Texas and New Mexico

By A. MORAZZANI and W. J. LYTLE, JR.

Schlumberger Well Surveying Corporation

THE "MicroLog"† is now recognized as a most useful record for evaluating the productive section penetrated by the drill. This relatively new logging instrument was introduced in the Permian Basin in March, 1949, and in approximately 1½ years its use has become commonplace. The MicroLog is being used chiefly for 2 purposes: The selection of perforation intervals for the immediate completion of the well; and for determining the net pay for reserve estimations. There is also a good chance that with further development it will be possible sometime in the future to estimate formation porosity from the MicroLog.

†Trade Mark, Schlumberger Well Surveying Corporation.

THE PROBLEM of accurately locating permeable beds in limestone and dolomite by means of the spontaneous potential log alone heretofore has made the completion of Permian Basin wells difficult. The introduction last year of the MicroLog has done much to pin-point these zones and has eliminated much of the guess work in perforating and cementing.

Solves Logging Problem

This new logging method was developed primarily for the accurate determination of permeable beds where the spontaneous potential log alone does not give a satisfactory answer. It is well known that in the Permian Basin dolomites or limestones it is difficult in many cases to determine the thickness of pays with the spontaneous potential curve. This problem exists because such formations are usually very resistive when compared to the drilling mud in the hole. Therefore, the more conductive mud serves to distort the SP currents and causes a rounded SP [1] curve. Such a curve generally gives the approximate locations of the permeable beds, but does not sharply define their boundaries. For this reason the MicroLog is particularly useful in the limestone pays, such as the San Andres, the Clearfork, the Wichita and the Wolfcamp limes of the Permian, and the Devonian, the Silurian and the Ellenburger limes of the Pre-Permian. It is, of course, well adapted for use in Pennsylvanian reef limes such as the Canyon reef pay in Scurry County.

It also finds importance in sand and shale formations such as the Yates of the Permian, the sands of the Upper Pennsylvanian in Scurry County, and the McKee and the Waddell sands of the Ordovician. In such formations the MicroLog is used for the precise location of the boundaries between beds, and for a better evaluation of the sand count.

Principles of MicroLogging*

The MicroLog [2] is a resistivity log recorded with electrodes spaced at short distances from each other in an insulated pad which is pressed against the wall of the drill hole. Electrode systems with 2 different depths of investigations

*Reg. U. S. Pat. Off.

are generally used in combination to produce 2 curves that are recorded simultaneously. For both systems the electrode spacings are very small, usually about 2 inches for the "long spacing" curve and less than that distance for the "short spacing" curve.

The Tool

The micrologging tool consists essentially of a rubber pad in which are embedded electrodes connected to insulated conductors contained in the cable used to lower the tool in the hole. The rest of the tool consists of a mandrel and springs designed to hold the pad against the wall of the drill hole as the assembly is moved up or down the hole. A sketch of the tool is shown in Figure 1.

In practice the micrologging device measures the average resistivity of the small volume of material which passes under the pad as it travels along the wall of the hole. The rubber pad prevents the mud from short-circuiting the electrode system while the curves are recorded. When the pad passes over an impervious bed on which no appreciable mud cake has formed, the resistivity recorded tends to approach that of the formation. In the case of a dense lime, for example, relatively high resistivities would be logged. However, when the pad passes over a permeable bed on which mud cake has formed, the mud cake intervenes between the pad and the formation. In this case an appreciable part of the small volume, the resistivity of which is being measured, consists of the mud cake. Therefore, as the resistivity of mud cake is of the same order as that of the drilling mud, the resistivities recorded opposite permeable beds are never very high, and are related to the resistivity of the mud. Moreover, the resistivities recorded on the shorter electrode system are more affected by the presence of the mud cake and, therefore are in general, somewhat lower than the resistivity recorded with the longer electrode system.

Mud Cake and Permeability

Thickness of the mud cake which forms on permeable beds is related somewhat to the degree of their permeability in the lower ranges. Therefore, it has been possible to give a qualitative permeability interpretation on MicroLogs. However, it is generally conceded that the thickness of the mud cake is not directly proportional to the permeability of the formation. Consequently, the MicroLog cannot, in its present stage of development, be interpreted quantitatively in terms of permeability. In general, it is the rule that when lime beds are being logged, impermeable beds will exhibit high resistivities while the permeable beds will exhibit much lower resistivities and can therefore be very accurately located. A typical log of the reef pay in Scurry County illustrating this point is shown in Figure 2. Another example in the lower Clearfork is shown in Figure 4.

Other Conditions

There are, however, conditions under which low MicroLog resistivities will be recorded other than opposite permeable beds, and these conditions are as follows:

- Opposite shales, the resistiv-

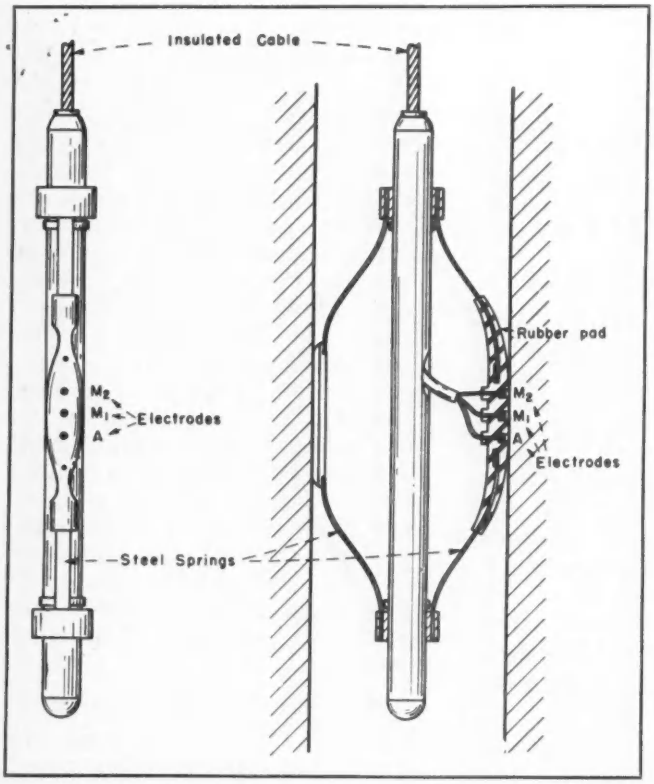


FIGURE 1 (Above). Microlog instrument showing assembly (left) and logging position in drill hole at right.

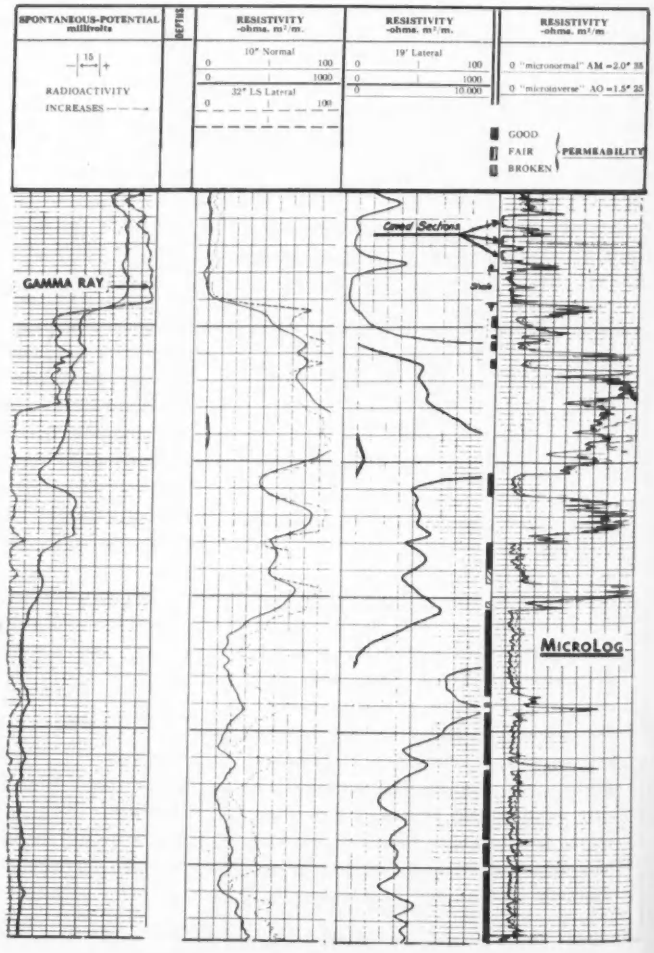


FIGURE 2 (Right). Example of Microlog in the Canyon reef of Scurry County, Texas, illustrating the electrical and radioactivity curves commonly used in conjunction with it.

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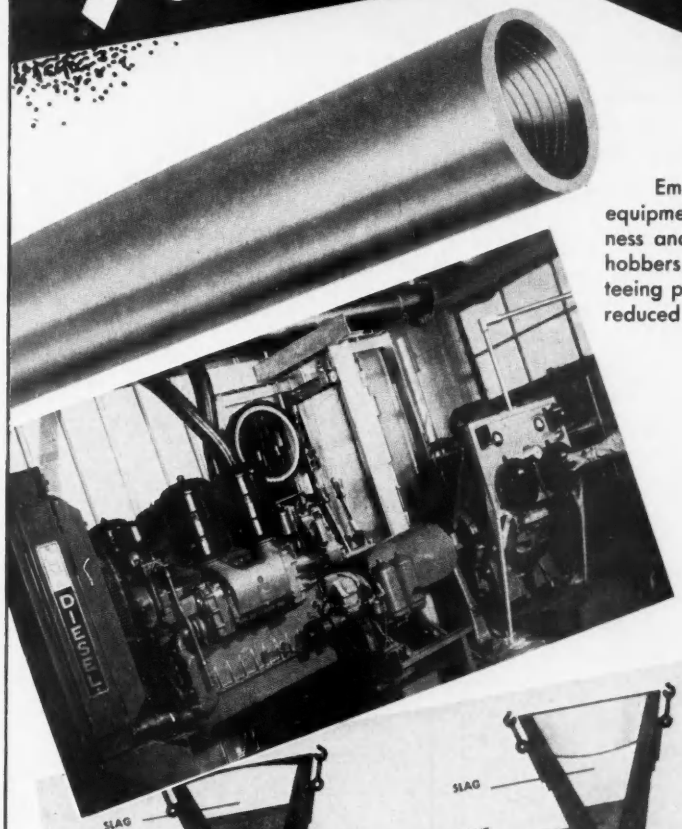

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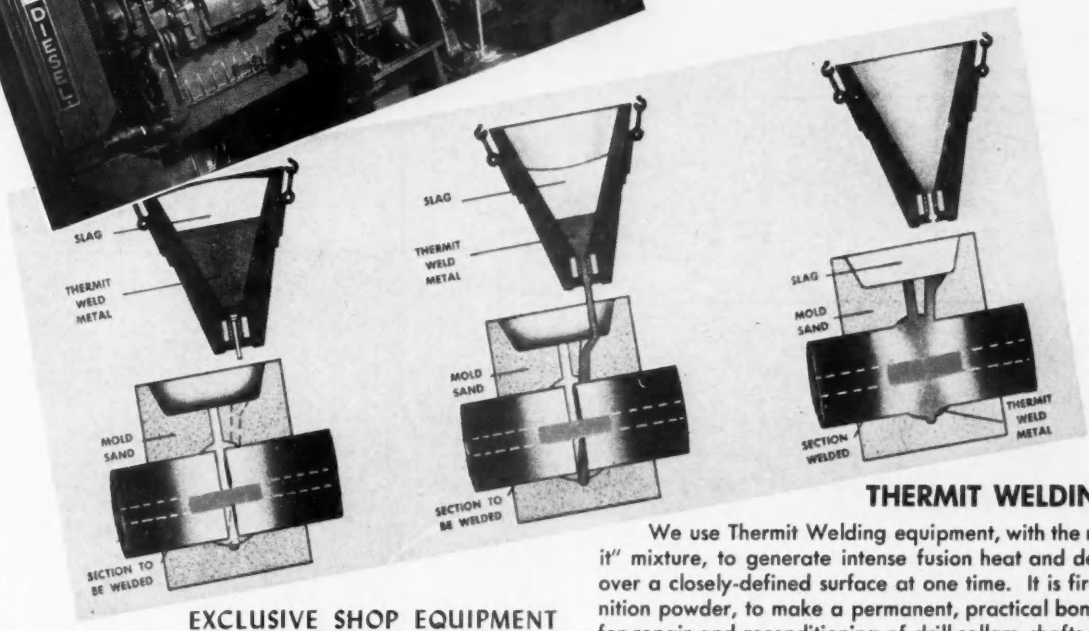

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ities of which are low. In this case, nevertheless, the resistivities read on the two curves are quite close to each other, whereas opposite permeable beds a separation is generally observed between the two curves, with the long spacing curve being above the short spacing curve. This feature makes possible the distinction between permeable sections and shales on the MicroLog. As an example, the Pennsylvanian sand and shale section overlying the reef pay in Scurry County is shown in Figure 3.

It may occur that no separation is apparent between the curves opposite sands the resistivities of which are low. In this case, shales and sands cannot be easily distinguished on the MicroLog, but the ambiguity is generally solved by means of the spontaneous potential curve.

● In caves in the drill hole where the pad does not make contact with the side of the hole and the electrodes are short-circuited by the mud. This point is illustrated in Figure 2. As may be seen in this example, usually in West Texas the readings in caves are so low that the cause is obvious.

The presence of highly-conductive minerals such as pyrites may lower the resistivity of the formation within which they are deposited, regardless of the porosity and permeability of these formations. But such a phenomenon is relatively rare.

Correlation With Other Data

Thus it can be seen that MicroLogs should be interpreted in conjunction with other available information whenever possible. The trend of the curves of the regular electrical log should be consulted in order to eliminate low MicroLog readings opposite shales or impervious mineral beds of low inherent resistance. If it is not possible to record a useful SP curve because of salty mud, a gamma ray log can be used to advantage to detect shale or shaly zones whose radioactivity differs from that of the other beds. The usually salty muds of the Permian Basin will not affect the MicroLog appreciably because, as explained above, the rubber pad serves to insulate the electrode from the mud in the bore hole.

When properly used in the light of available data, the MicroLog is valuable in getting an accurate count of the pay footage. The excellence of results obtained with this revolutionary new device is confirmed by its increasingly wide use in West Texas and New Mexico.

REFERENCES

1 "SP Log—Theoretical Analysis and Principles of Interpretation" by H. G. Doll, Petroleum Technology, Sept. 1948.

2 "The MicroLog, A New Electrical Logging Method for the Detailed Determination of Permeable Beds," H. G. Doll, Petroleum Technology, June, 1950.

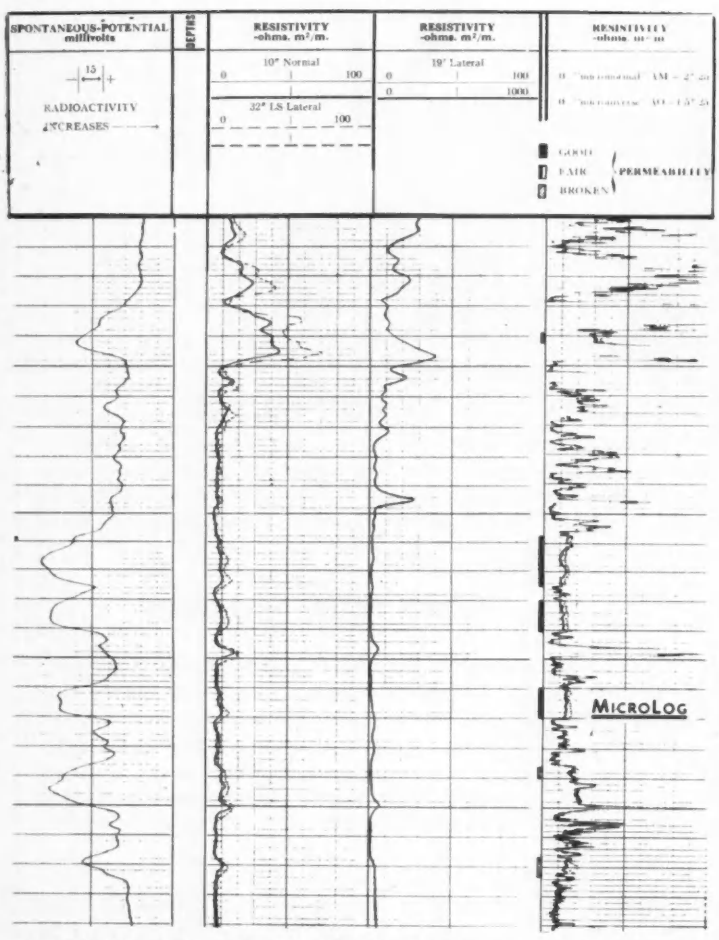

FIGURE 3 (Above). Example of the MicroLog in the upper Pennsylvanian shales and sands above the reef in Scurry County.

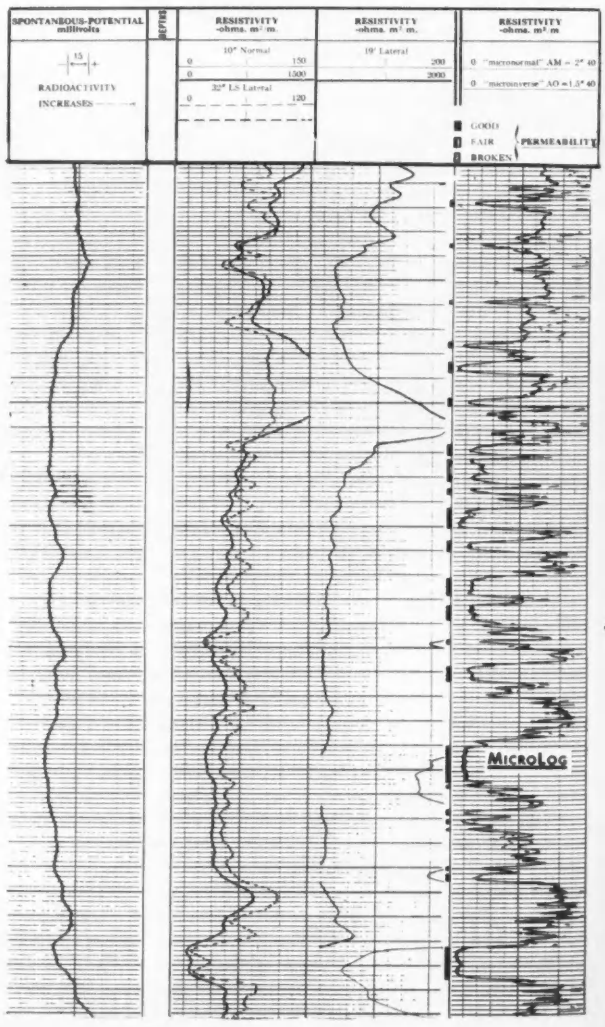

FIGURE 4 (Right). Example of the MicroLog in the lower Clearfork of the Permian in the Andector field, Ector County, Texas.

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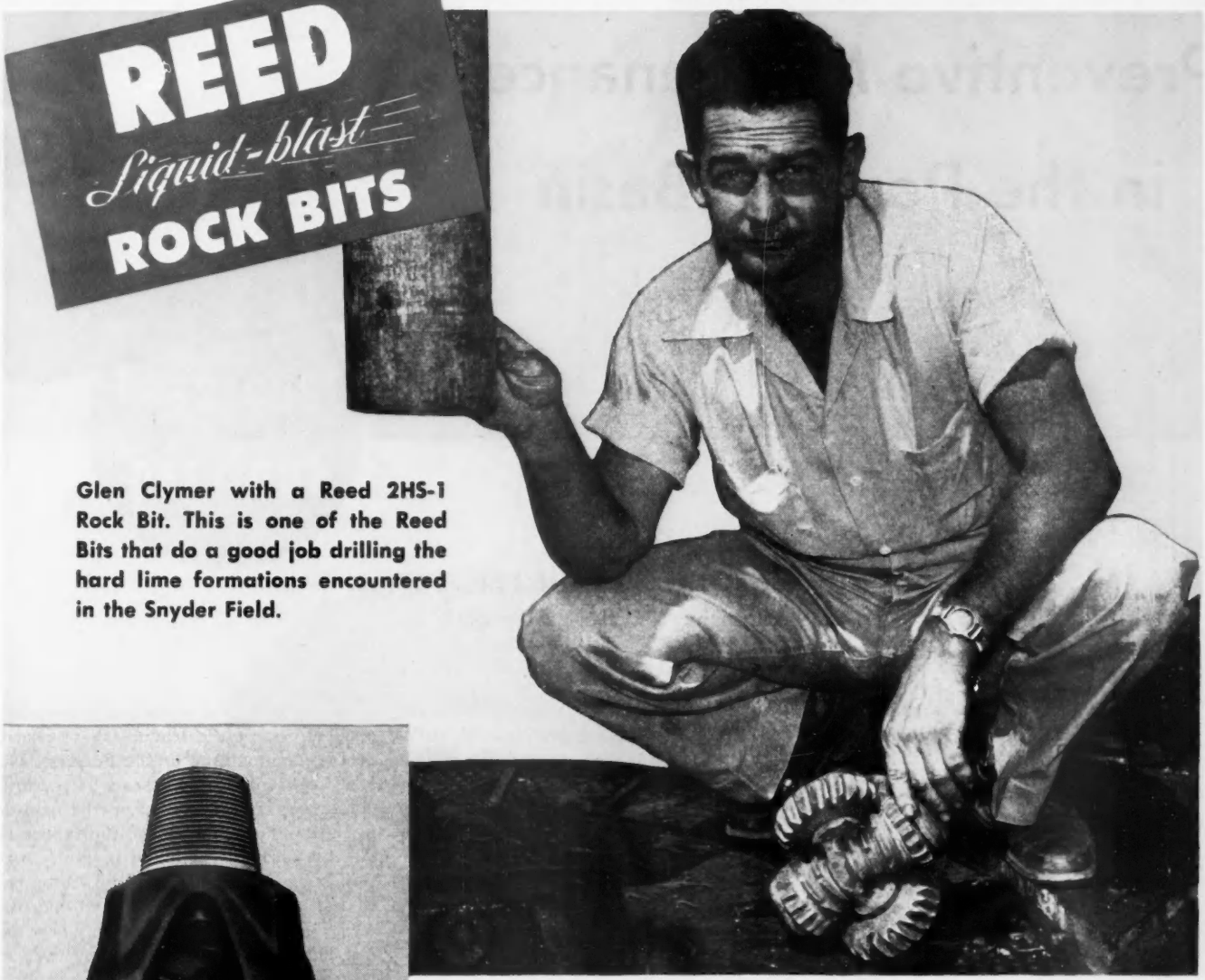

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2531

Drill Collar Preventive Maintenance in the Permian Basin

By JOHN B. COULTER, JR.
Sales Engineer, Welex Jet Services, Inc.

A FEW years back drill collars were run simply as a means of stabilizing the drill stem at a point directly above the bit and a string of collars rarely ever consisted of more than two or three joints. Today, however, it is not uncommon to see from 18 to 21 collars on a string on nearly every rig in the Permian Basin.

As drilling techniques have changed, so has the use of drill collars. Not only do they act as a stabilizer directly above the bit, but more important, they serve to concentrate the drilling weight at the very point where it is most efficient. They tend to "plumb-bob" the bit, having the effect of drilling straighter hole at a greater rate of penetration than was thought possible just a few years ago. These multiple strings of drill collars are considered highly practical in that, not only are faster drilling rates achieved, but excessive wear and tear on the drill stem as a whole is decreased and the result is a saving on maintenance of the drill pipe and tool joints. If 90 percent of the drill collar weight is applied on the bit, then we should expect that at least a part of the drill collars and all the drill pipe are in suspension. This is considered an ideal situation.

Multiple strings of drill collars had been used to a limited degree for only a short time when suddenly the practice "snow-balled" until nearly every rig in the Permian Basin was running up to 18 to 21 collars. As the number of drill collars was increased, so did the number of pin and box failures. We are now convinced that we must run long strings of collars, but how are we going to eliminate these costly fishing jobs? Our only answer at this time is through what we prefer to call preventive maintenance.

The writer has been closely connected with the problems of manufacture and maintenance of drill collars for approximately 11 years, and during this time has actually inspected innumerable drill collars in the field to determine the causes of pin and box failures, such failures being a constant hazard to profitable drilling. The writer inspected drill collars bearing the trademark of nearly every manufacturer in the business and can recall only a few cases where a drill collar was rejected either in the field or in the field machine shop, the failure of which could be attributed to faulty materials or workmanship during the process of manufacture. Thus, we narrow our causes down to the point where we can pursue a direct line of approach to the problem at hand, which is preventive maintenance.

PREVENTIVE maintenance of drill collars in which the collars are maintained in top condition through frequent reworking of connections, is shown to reduce greatly the possibility of fishing jobs through pin or box failure. Reduction of pin size as the collar wears is advocated to maintain structural strength, and proper inspection is stressed to avoid needless waste of collar ends when re-machining threads.

Selection of Drill Collars

When purchasing a string of drill collars, it is recommended that the manufacturer's representative be consulted and the drilling program be discussed with him. In many cases he can help in choosing the most economical and efficient string for the operator's purposes.

Assume, for example, that the operator anticipates drilling 7⅞- and 8¾-inch holes with these collars and that the maximum weight on the bit will be approximately 60,000 pounds. The author recommends the purchase of drill collars which can be washed-over in either of the above hole sizes and still be large enough on the outside diameter that maximum weight per collar can be realized. Also, with weight in mind, one should consider a bore which will impose

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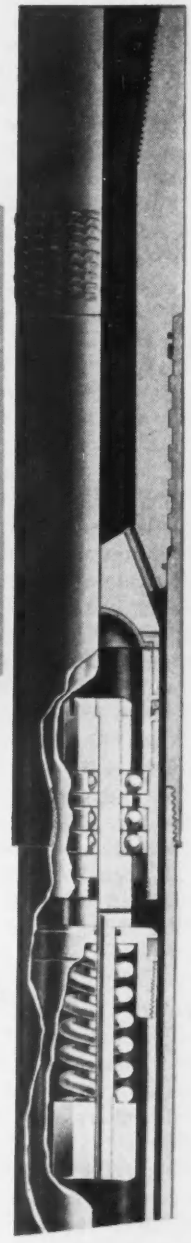

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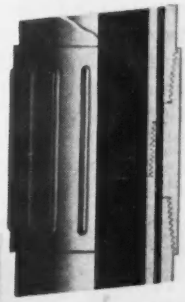

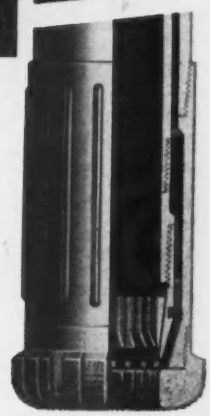

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the least restriction in mud flow and a bore small enough that outside diameter wear on the collar will not make it impractical to machine new pin and box connections. These new connections should become progressively smaller as the outside diameter diminishes. Therefore, careful consideration should be given to the selection of a bore small enough to allow the machining of a well-balanced pin and box connection, since the sizes of the connection are progressively decreased from 4½- to 4- to 3½-inch. This procedure will increase the useful life of the drill collar string.

Buoyancy Factor

The operator should purchase enough drill collars to run the desired weight on the bit and still not use in excess of 90 percent of the total drill collar weight. It must be remembered that a drill collar will weigh less when suspended in the drilling fluid than it does on top of the ground, due to the buoyancy of the fluid. In 9.8-pound mud, for example, the collar will lose approximately 15 percent of its weight.

With the above in mind, one would purchase at least twenty-five 6¾-inch outside diameter collars 30 feet long with a 2¼-inch bore. Each collar weighs approximately 3240 pounds. Thus, the drill collar string would weigh 81,000 pounds in air or 68,850 pounds suspended in 9.8-pound drilling mud. If only 90 percent of this weight is on the bit there still will remain 61,965 pounds, which is 1965 pounds above the desired 60,000 pounds. This leaves 10 percent of the drill collars and all the drill pipe in tension.

After the collars have been selected, we are confronted with the problem of selecting the best possible connection from a service standpoint. This is a controversial subject and is largely up to the operator himself. The writer would recommend a 4½-inch H-90 pin and box connection for drill collars only, not for tool joints. This connection (Figure 1) has 3½ threads per inch, two inches taper per foot, and a 90-degree included angle between the thread flanks.

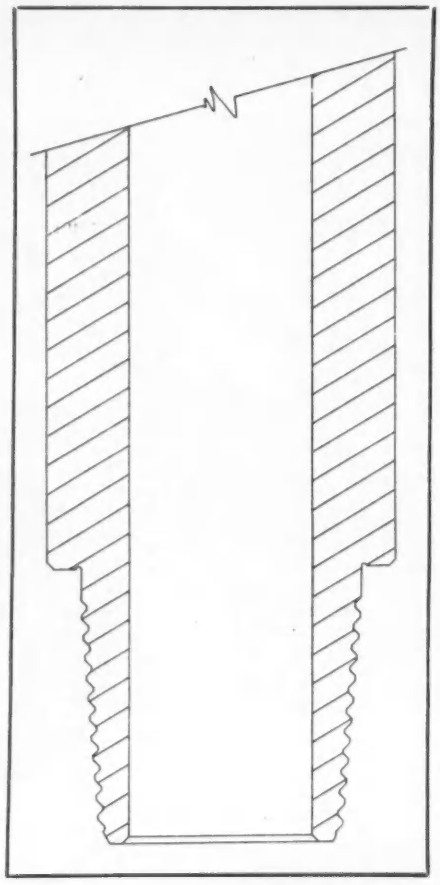


FIGURE 1. Cross-section of H-90 type of joint which, because of its coarse threads, is easily made up, is less susceptible to surface scars caused by handling and is easily cleaned and doped.

This type of connection gives a coarse joint and field service conditions seem to indicate that this joint gives better and longer service, for the following reasons:

- Faster make-up and breakout.
- Coarse thread form is stronger and less susceptible to surface scars caused by handling.
- Coarse thread is easier to clean and dope.

Surface Stressing

Regardless of the type of connection that is decided to be run, the writer strongly recommends surface stressing of the thread roots on all new connections. Figures prove that this cold-working process actually increases the strength of the threaded connection three to four times in notch fatigue. This does not mean that pin and box failures are over, or that these connections will run three to four times as long, but it is an added protection against fatigue type failures and is well worth the additional cost. This can be done in numerous field shops throughout the oil fields.

With new connections on our new string of collars, we are ready to go in the hole. From this point on, these drill collars can bring about a great saving through increased drilling rates, or they can be exceedingly costly through needless fishing.

It is recommended that all pin and box connections, whether new or old, be protected with thread protectors made especially for this purpose; also, that these protectors remain on the pins and boxes at all times except when actually in use. Protectors should be removed and installed on the derrick floor only. This care will prevent scarring of the shoulders and the thread crests, the latter being the origin of severe galls and ultimate failures and fishing jobs.

Pins, in particular, should be washed clean on each trip, specifically those set back on the pipe rack, since the drilling fluid which drains from the inside walls of the drill pipe and drill collars often contains abrasive sands and shales. These particles, if large enough, can become wedged between the thread flanks or pin and box shoulders. This condition also can cause galling or seizing, which could result in ultimate failures.

Periodic Inspection Important

Periodic inspection for fatigue cracks in the pin and box connections will prevent many fishing jobs. There are several service companies which perform this service at the rig. The approximate cost to check 25 drill collars for fatigue cracks is $187.50. One "pickout" fishing job would cost at least $1000. Another advantage of this type of inspection is in the saving of valuable drill collar stock. Ordinarily, a field machine shop will cut off four inches from each end of the joint, when a drill collar is sent in to be re-worked, in order to make certain the new connections are behind any fatigue cracks. If the locations of these cracks are known beforehand, then possibly only three-quarters of an inch

Table 1

For quickly determining weights in air, in pounds per foot, of drill collars when outside and inside diameters are known.

Drill Collar Weights—Pounds Per Foot

O.D. Drill Collar, Inches	BORE OF DRILL COLLARS, INCHES										
	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾	4
4¼	42	40	37	....	....	....	....	....	....	....	....
4½	48	46	43	....	....	....	....	....	....	....	....
4¾	54	52	50	47	44	....	....	....	....	....	....
5	61	59	56	53	50	....	....	....	....	....	....
5¼	68	65	63	60	57	....	....	....	....	....	....
5½	75	73	70	67	64	61	....	....	....	....	....
5¾	82	80	78	75	72	68	64	60	....	....	....
6	90	88	85	83	79	76	72	68	....	....	....
6¼	98	96	94	91	88	84	80	76	72	....	....
6½	107	105	102	99	96	92	89	85	80	....	....
6¾	116	114	111	108	105	101	98	93	89	....	....
7	125	123	120	117	114	111	107	103	98	93	84
7¼	134	132	130	127	124	120	116	112	108	103	93
7½	144	142	139	137	133	130	126	122	117	113	102
7¾	154	152	150	147	144	140	136	132	128	123	112
8	165	163	160	157	154	151	147	143	138	133	122
8¼	176	174	171	168	165	161	158	154	149	144	133

might have to be cut off each end. This would result in a saving of 6½ inches of drill collar. This is important in that, should a drill collar become less than 27 feet long, it is almost too short to handle in the derrick without the use of extra-long lifting subs. Thus, approximately 1½ feet on each end of a drill collar, or a total of three feet, represents the original investment. This, in effect, makes the collar worth approximately $100 per foot. For this reason, inspection for fatigue cracks at the end of each well will prove to be a profitable investment not only by aiding in preventing fishing jobs, but by saving valuable drill collar length as well.

Examples of Savings

As an example of such savings, there is the case of one drilling contractor in the Permian Basin who operates four or five rigs and who was continually fishing for his collars. He began having his collars inspected upon completion of each well, and at this writing he has not had a collar-fishing job on any of his rigs in approximately seven months.

Another drilling contractor who was continually fishing for his drill collars has cut his fishing jobs to a bare minimum through periodic inspection. He was running strings of fifteen 6¼-inch drill collars, but it was found that upon completion of each well he still had to re-shop approximately 10 to 12 pins and boxes, usually involving the same number of drill collars. This was alarming to the inspectors since the new connections were making only 6700 feet of hole before these fatigue cracks would be in evidence again, and they should have been making considerably more footage. In this particular case, it was found that he was using this same string of collars to make 1700 feet of 11-inch surface hole and turning his rotary at approximately 120 revolutions per minute. New connections, inspected upon completion of the surface hole, showed pure fatigue cracks in the early stages of development. In the writer's opinion, these cracks were the result of drilling at high rotary speeds and with excessive weights in a hole too large to allow any natural stabilization of the drill collars through at least momentary contact with the wall of the hole. This opinion is substantiated by the fact that when this same string of collars was run only in the 7⅞-inch hole and upon completion of the well, no fatigue cracks were found in the string of collars.

In order to avoid the continuous reshopping of the pin and box connections, it is advisable to run seven- or eight-inch outside diameter collars in drilling the larger size holes. Larger diameter collars are more rigid and offer increased stability to the drilling string as a whole, and the result will be fewer fatigue type failures and a reduction in maintenance costs.

The origin of fatigue cracks is a highly controversial subject and in the writer's opinion, such cracks could be entirely eliminated if we knew the exact causes. But, since we do not, we must continue extensive research and counteract these causes where possible by the process of elimination. We do know that fatigue cracks fall into three main categories:

- Pure Fatigue
- Corrosion Fatigue
- Wobble Fatigue

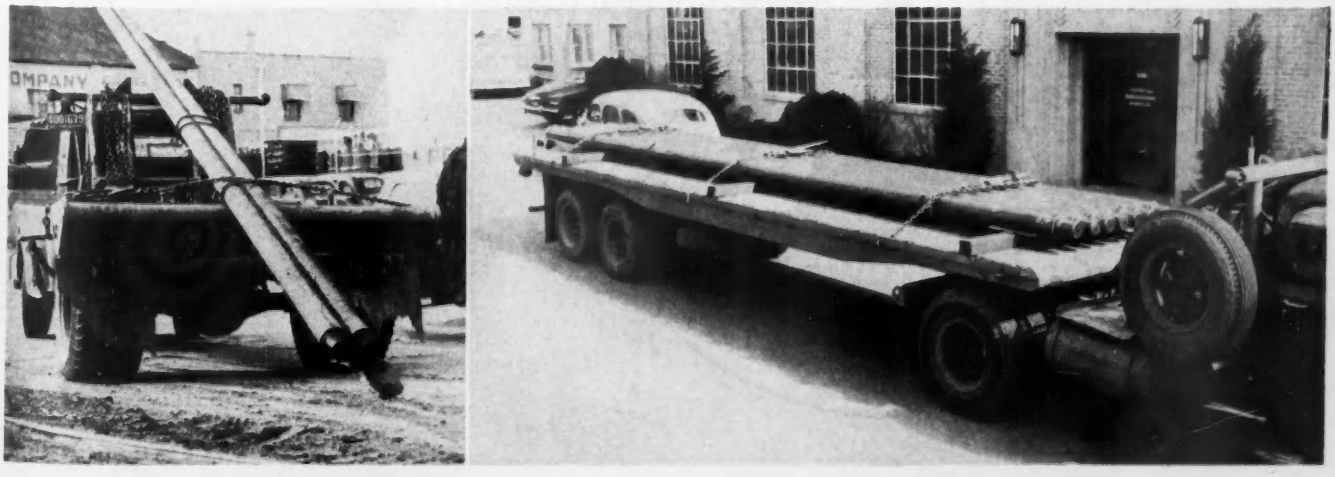
Pure Fatigue

It is generally thought that pure fatigue cracks are the result of stress concentrations set up while drilling. These stress concentrations probably are caused by transverse vibrations or sine waves. As these waves move through the drill collar string, they are thought to change in frequency and even to reverse themselves. If this is the case, then a concentration of stresses would be induced and would act on the weakest point in the drill collar, this point being the threaded connection. There are a number of critical factors acting together to produce these failures, torque, compression, tension, shear and vibration from impact are some of them. The combination of some or all of these will determine the magnitude and the frequency with which fatigue cracks occur. According to Marks' Handbook (4th Edition), rotating shafts at certain speeds (critical speeds) become dynamically unstable and large vibrations are likely to develop. This phenomenon is due to resonance effects. The critical speed for a shaft is that speed at which the number of revolutions per second of the shaft is equal to the frequency of its natural vibration. A shaft at its critical speed is in a state of maximum sensitiveness (or indifferent equilibrium) so that the smallest force, if allowed sufficient time, may deflect it to infinity and break it.

Correct Speed Necessary

The most minute deviation, however, from the mathematically exact critical speed is sufficient to restore to the shaft a considerable amount of its elastic resistance. In the vicinity, therefore, of its critical speed, a shaft merely undergoes more or less intense vibrations, which are generally transmitted to the support. The deflecting force may be due to some external cause, but it is usually supplied by the almost unavoidable devi-

FIGURE 2 (A and B). Illustrated are the wrong and right ways to handle drill collars when they are hauled to and from the field. A bad practice which can cause a permanent bow to be placed in the collar is illustrated in (A), left, where the collars are supported only at both ends and pulled down in the center with the winch line. Drill collars always should be equipped with thread protectors and hauled on a "float," securely lashed down as shown in (B), right.

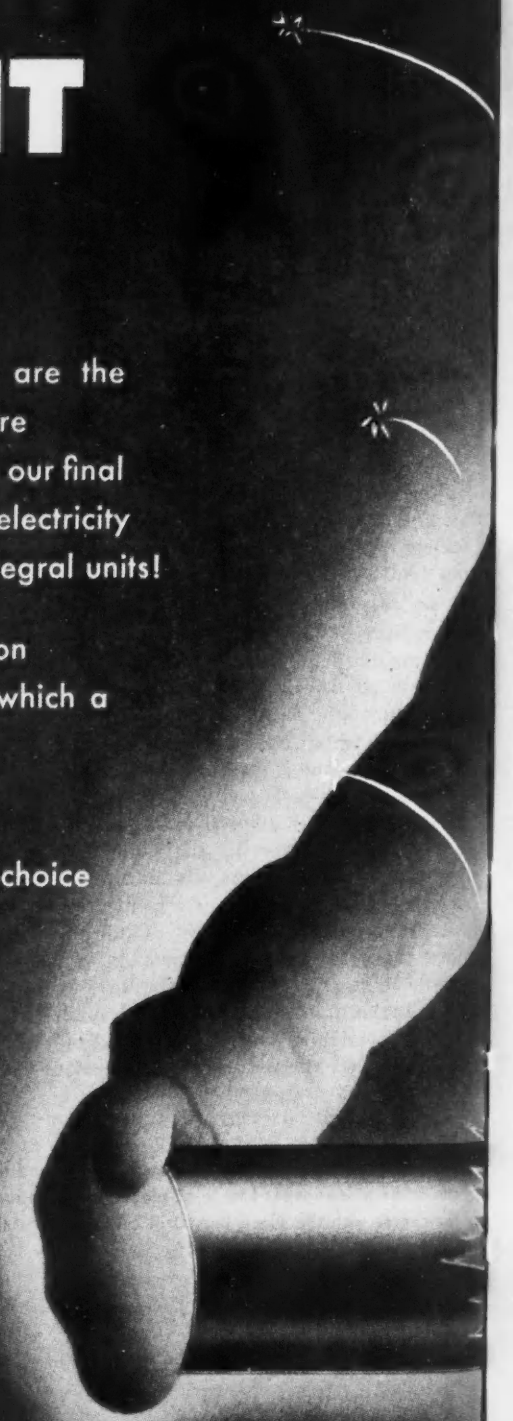


DESIGNED RIGHT
MADE RIGHT

American Iron FLASH WELDED Tool Joints are the latest addition to our line of rotary tool joints! They're designed right — made right — from start to finish. In our final manufacturing process, gigantic controlled surges of electricity flash weld these tool joints to drill pipe — forming integral units!

With American Iron FLASH WELDED Tool Joints on your drill pipe, you profit by the many advantages which a unitized drill stem provides!

American Iron FLASH WELDED Tool Joints are available with or without hard metal bands — and a choice of 18° or square shoulder design.



AMERICAN IRON & MACHINE WORKS CO., OKLAHOMA CITY, OKLAHOMA, BOX 1177 • PHONE L.D. 518

ations of the centers of gravity of the various loads from the center line of the shaft. By reducing these deviations to a minimum by fine workmanship and very careful balancing, the vibration at the critical speed may be made scarcely noticeable. However, until such a time as it would be economically sound to balance dynamically a drill collar, we must use some discretion in our operating practice. The following practices are recommended:

- Run at least 90 percent of the collar string in compression.
- Unless the collar string is stabilized, do not exceed the maximum revolutions per minute recommended by the seller.
- Make certain that the collars are straight at all times and that the threaded connections are in perfect alignment with the body of the collar so that the string of collars will run as an integral shaft rather than as an unbalanced agglomeration of 25 individual pieces.

Corrosion and Wobble Fatigue

Failure caused by corrosion fatigue occurs in the box connections only, and is the result of the same forces which cause pure fatigue except that corrosion pits in the roots of the exposed threads in the bottom of the box hasten these failures. Corrosion in this area can be retarded by the application of a corrosion resistant plating. This is being done at the source of manufacture, and in a number of field machine shops as well.

Failure caused by wobble fatigue occurs as the result of mishandling by field personnel and lack of sufficient protection to the threaded connection through the lack of thread protectors when collars are not in actual use. In order to prevent premature failures due to mishandling, we would suggest the following procedure:

- Never allow drill collars to be hauled on a winch truck with the collar suspended at either end by the headache post and the tail board and pulled down in the middle by the winch line, as shown in Figure 2A. This can cause a permanent bow in the collar. Drill collars should be hauled on a "float" as shown in Figure 2B.
- Never allow truckers to drop drill collars on to a pipe rack. Instead, joints should be rolled off the float and down an incline to the rack. Sudden dropping can produce a short kink.
- Thread protectors should be removed and along with the threaded connections should be washed clean with kerosine. The joints should then be visually inspected for nicks or burrs on the threads and shoulders. If possible, they should be dressed with a three-cornered file. If not, they should be set aside and marked for the shop. When this operation is completed, the joints should be re-doped and the protectors replaced and never removed except on the derrick floor before stabbing.
- At all times, when making up a connection, it should be cleaned and doped not only in the threads, but also on the face of the shoulders. The pin should be stabbed in the box as easily as possible to avoid scarring or breaking. Once stabbed, it is best that the connection be made up slowly. This slow rotation should apply to breakout also. In breaking out, the pin should not be "jumped" out of the box. There should be just enough tension in the hook spring to cause the pin to hang free in the box after it has become disengaged.
- A superior quality joint lubricant should be used. Some manufacturers have set up specifications for a joint lubricant and again we suggest that the manufacturer's representative be consulted.
- Outside diameter of drill collars should be checked upon completion of each well to make certain that the type of joint being used is still safe to run. As wear on the outside diameter of the collar progresses beyond a predetermined point, a pin and box connection becomes no longer dimensionally safe to run. That is, a 4½-inch API-FH connection is safe to run on a six-inch O.D. by 2¼-inch I.D. collar until this collar has worn down to an outside diameter of between 5⅝- and 5½-inches. At this point, the radial width of the shoulder and the wall thickness of the box through the threaded section are no longer sufficient to withstand fatigue stresses without danger of premature failure. In order to strengthen the threaded connection, it becomes necessary to machine a 4-inch API-FH pin and box on this collar. The smaller connection will allow a wider radial width of shoulder and a thicker wall through the box at the threaded section, which is the most critical point. The following examples are given:

	Collar	Connection
New		
	6" O.D. by 2¼" I.D.	4½" API-FH
Used—Still Safe		
	5¾" O.D. by 2¼" I.D.	4½" API-FH
Used—Unsafe		
	5½" O.D. by 2¼" I.D.	4½" API-FH
For Balanced Connection Machine to		
	5½" O.D. by 2¼" I.D.	4" API-FH

- As much consideration should be given to the selection of a field machine shop as would be given to the selection of a doctor. The better field shops should have lead, taper and thread form gauges, in addition to hardened and ground ring and plug gauges, to insure interchangeability in the threaded connections. Ring and plug gauging only will not insure interchangeability and means absolutely nothing except that the pin and box shoulders are faced to gauge. If the lead and taper are off on the machines in one shop and not in another, and even if they used identical ring and plug gauges, chances are highly in favor of finding that the pin machined in one shop would not mate with the box turned in the other. It is important to make certain that the shop that does this work is fully equipped to accurately gauge the pin and box connections.

Summary

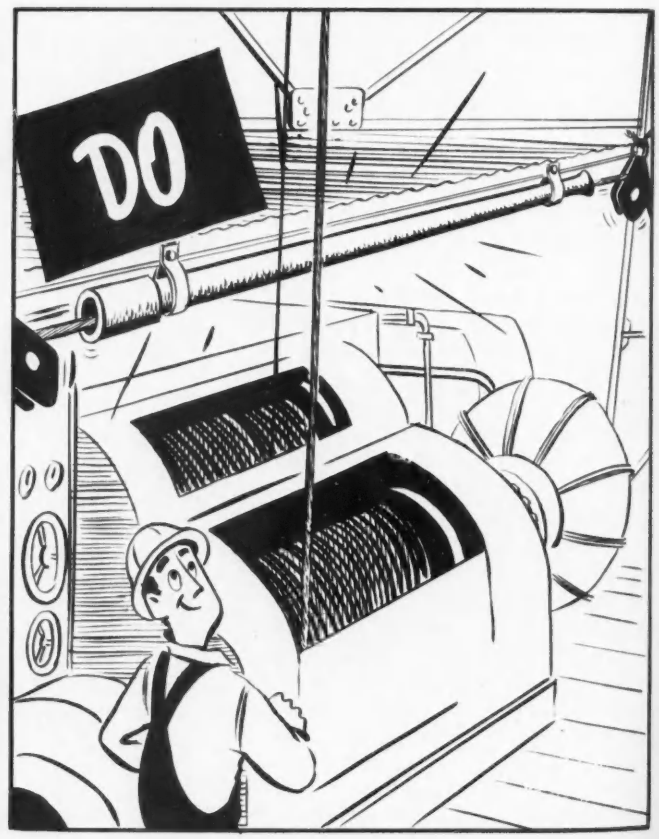
It is recommended that the manufacturer's representative be consulted in matters pertaining to the purchase, care and operation of your drill collars. He is especially trained along these lines and his experience, along with yours, should prove a practical and economical combination leading toward more profitable and trouble-free drilling.

About the Author

JOHN B. COULTER, JR., upon graduation in 1938 from George Washington University with a degree in mechanical engineering, worked for several years in the field as a roughneck and driller. He joined Hughes Tool Company and was with that company seven years, becoming district engineer in the West Texas-New Mexico district. In 1949 he resigned to help establish The Drill Collar Service Company, with which company he was affiliated until January 1 of this year when he joined American Iron and Machine Works as sales engineer in the West Texas Division, with headquarters in the Odessa, Texas office of the company. In March of this year he became sales engineer for the Welex Jet Services, at Odessa.

World Oil Graphics

MANILA LINE CARE



BREWSTER N12 DRAWWORKS SPECIFICATIONS

Drum Speed	Line Speed	Line Pull	Rotary Speed
34.4 RPM	285'/min.	126,000#	56.2
50.1	416	89,000#	83.5
72.6	603	59,000#	122.0
105.9	880	42,000#	177.0
135.5	1,126	31,000#	162.0
197.8	1,644	22,700#	236.0
286.5	2,381	15,300#	341.0
418.2	3,476	10,700#	500.0

TRANSMISSION

4 speeds forward—1 speed reverse—2" P. triple chain, 174,000# breaking strength—24T minimum sprocket size—1672'/min., max. chain speed—shaft bearings—SKF 2232, 6-5/16 I.D., 232,000# capacity.

N-12 COMPOUND SPECIFICATIONS

CHAINS:

Drawworks drive 1½" P. quad.
Between motors 1½" P. quad.
Pump drives 1½" P. sextuplet.

CLUTCHES:

Fawick to fit motor.
30 x 525 Fawicks on pump drives.
Positive clutch on each motor shaft for distribution of power to drawworks and pump.

GENERAL SPECIFICATIONS

All block clutch drives inside transmission case.

Friction clutches all outside for service accessibility.

All operating clutches air operated.

All chains run in oil-tight guards with oil pressure lubrication.

All shafts mounted on roller bearings with oil pressure lubrication.

Rotary drive chain 1½" P. double chain.

Cathead drive chain 2" P. double chain

2—oil pumps individually driven for safety.

Oil-tight flexible guard to compound.

All chains and bearings lubricated with oil from pumps.

Both pump drives rated 850 H.P. each for biggest mud pump.

Oilbath box constructed of ¾" and ½" plate.

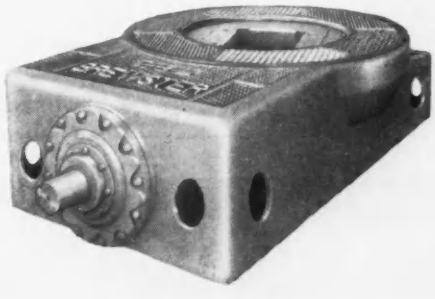
All shafts and sprockets mounted on roller bearings.

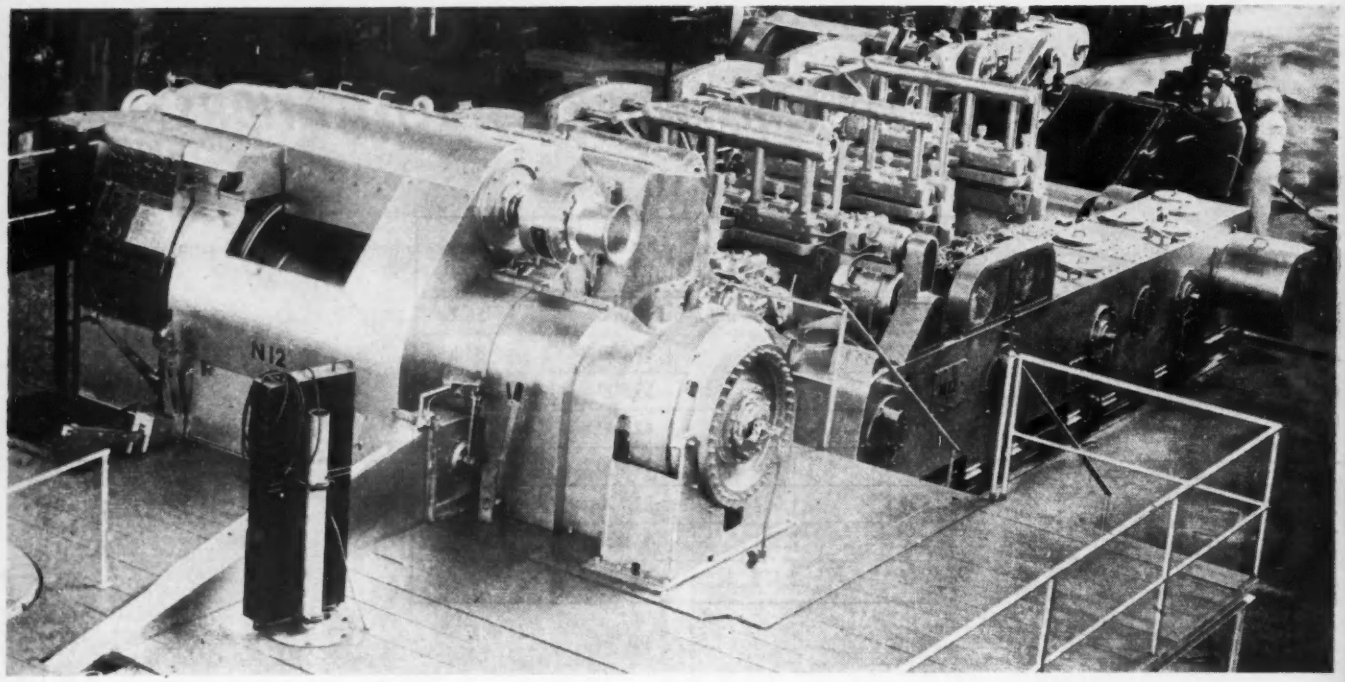
Drives provided for 2 air compressors and 1 generator.

Motor throttles air operated by driller.

Motor tachometers mounted in control panel at driller's position.

N-12 Matched Equipment





Power Rig Design for Deep Drilling

By ELTON STERRETT
Engineering Editor

THE trend toward deeper drilling, with heavier loads, larger drilling lines, augmented power demands, and more sustained operating periods, places an ever increasing responsibility on the manufacturer of drilling equipment who strives to keep abreast of the drilling industry's advancement and to provide power and effective means of its utilization at the bit, as much as 3 miles below the surface. One such instance is the design and announcement of the new drawworks and power unit by Brewster Company, Inc., of Shreveport, which recently made the first public showing of a unit for drilling to 12,000 feet or more.

Engineering development of such a rig involves more than the mere expansion of the design of a smaller rig—one of lesser capacity—to meet the demands of deep drilling. On Brewster's new N-12 rig, for instance, more than 10,000 drafting hours went into the drawing board design of the rig and completion of the working blueprints from which the unit was assembled. Originally contemplated more than 2 years ago, actual development consumed 18 months, during which time several thousand drawings were made.

The new N-12 drawworks carries a design rating of 1200 horsepower, with the power derived from four 350-horsepower internal combustion engines, all of which may be compounded to the drawworks if desired. A compact chain-type transmission, with dual shafts which carry jaw or block clutches for compounding between shafts and overriding sleeves, provides 8 forward speeds and 2 in reverse. Generated gear-tooth faces are used for the drive between shafts and sleeves. These formed gear teeth were chosen to give greater bearing surface and improved load distribution as compared to splined and broached matching parts.

TABLE 1

Drum and Line Speed Combinations

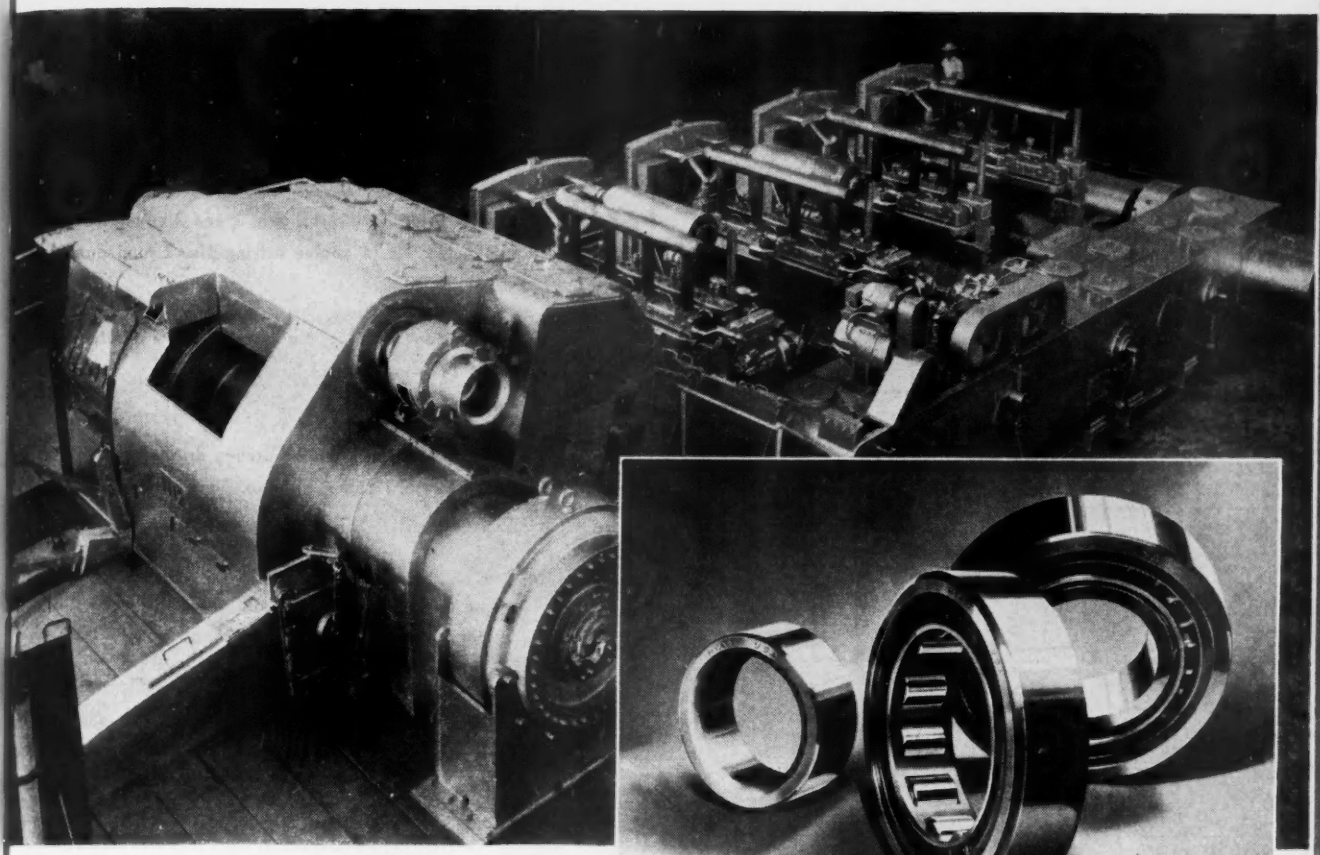
Drum Speed Rpm.	Line Speed Feet/min.	Line Pull Pounds	Rotary Speed Rpm.
34.4	285	126,000	41.2
50.1	416	89,000	59.8
72.6	603	59,000	86.7
105.9	880	42,000	126.7
135.5	1,126	31,000	115.9
197.8	1,644	22,700	169.4
286.5	2,381	15,300	245
418.2	3,476	10,700	357

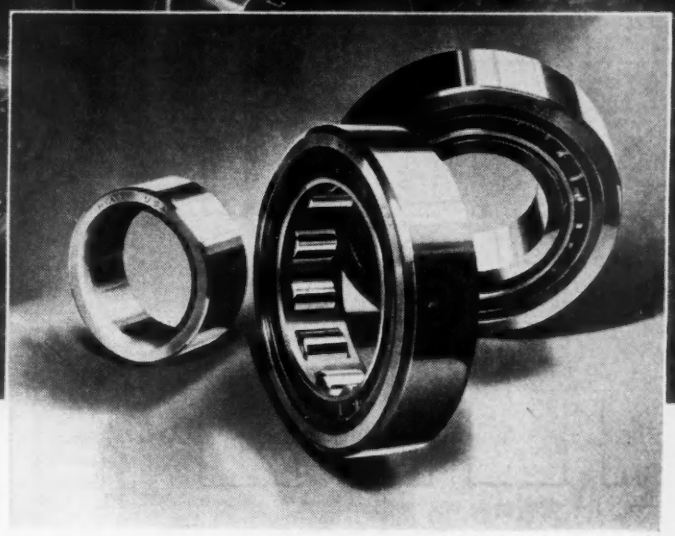
The rotary table, being driven through the drawworks transmission, likewise has 8 forward speeds with wide range from 41 to 357 revolutions per minute and 2 reverse speeds available, while the cathead shaft has 4 forward speeds, in the range from 98.5 to 304.2 rpm.

Controls Air-Actuated

All air-operated friction clutches are used with the exception of the 2 double-faced block clutches within the drawworks speed box. These friction clutches are all outside mounted, and may be serviced or replaced without entering the drawworks shell. High-speed chain is used throughout for drives between shafts, the largest being the 2-inch pitch quadruple chain on the low speed drum drive. These chains are all operated in oil baths, with pump circulation of oil to each chain. Minimum sprocket size is 24 teeth, with the maximum chain speed being 1672 feet per minute. (See Table 1.)

All controls for the N-12 and its power units are air-actuated and





BREWSTER N-12 DRAWWORKS

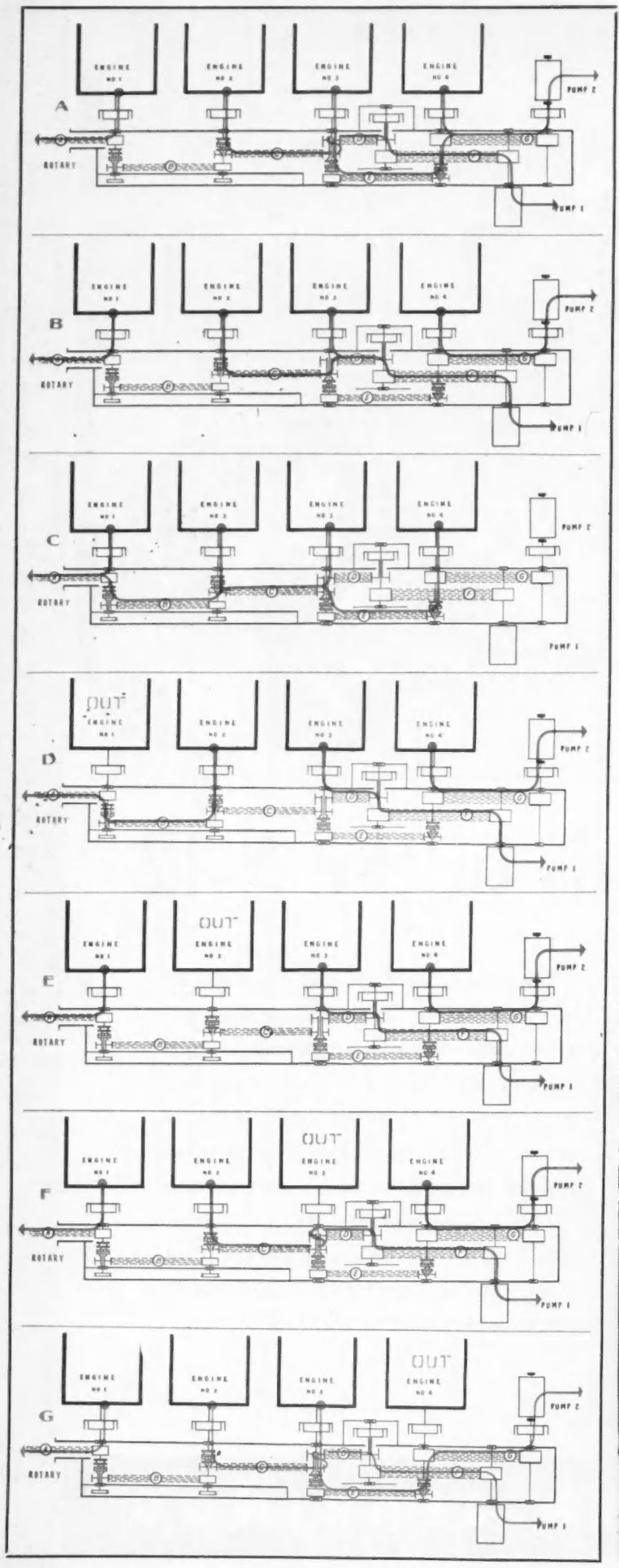
Hyatt Hy-Loads in the N-12

Leading makes and types of oil field equipment have their quota of Hyatt Hy-Loads and we are happy to include the new Brewster N-12 Drawworks among them.

Because Hyatt Roller Bearings have served long and well in Brewster products, as they have in all other equally-known quality equipment, it was but natural that Brewster would continue to use Hyatts in their latest and largest rig.

Therefore, we take this opportunity to congratulate Brewster on this new drawworks, for like all petroleum machinery builders and users too, they know that when dependable bearings are needed to carry loads, to provide smooth running shafts or wheels, Hyatts fill the requirements. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey; Chicago, Detroit, Pittsburgh, and Oakland, California.

HYATT ROLLER BEARINGS



A. No. 1 engine driving drawworks, No. 2 engine driving No. 1 mud pump. Nos. 3 and 4 engines driving No. 2 mud pump.

B. No. 1 engine driving drawworks. Nos. 2 and 3 engines driving No. 1 mud pump. No. 4 engine driving No. 2 mud pump.

C. All 4 engines connected to drawworks, giving a total of 1400 horsepower at drum.

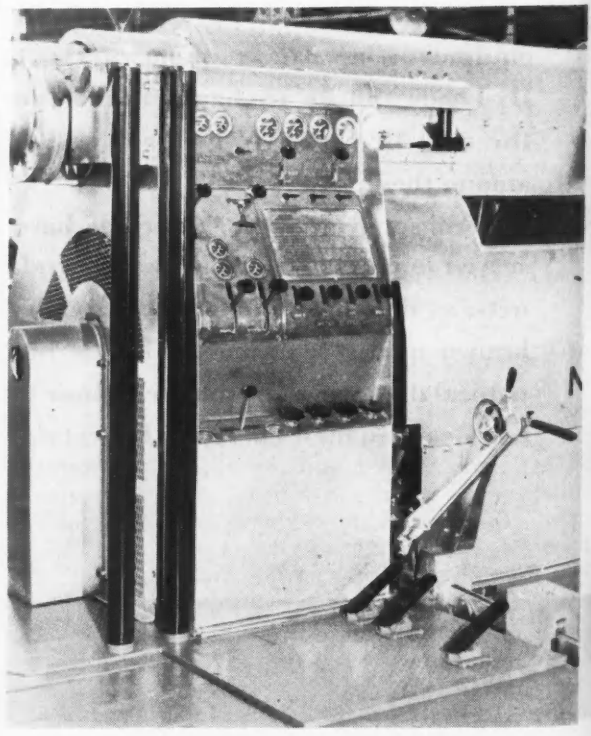
D. No. 1 engine down. No. 2 engine driving drawworks. No. 3 engine connected to No. 1 pump, with No. 4 engine driving No. 2 mud pump.

E. No. 1 engine driving drawworks. No. 2 engine down. Nos. 3 and 4 engines connected to No. 1 and No. 2 mud pumps.

F. No. 1 engine driving drawworks. No. 2 engine connected to No. 1 mud pump. No. 3 engine down. No. 4 engine driving No. 2 mud pump.

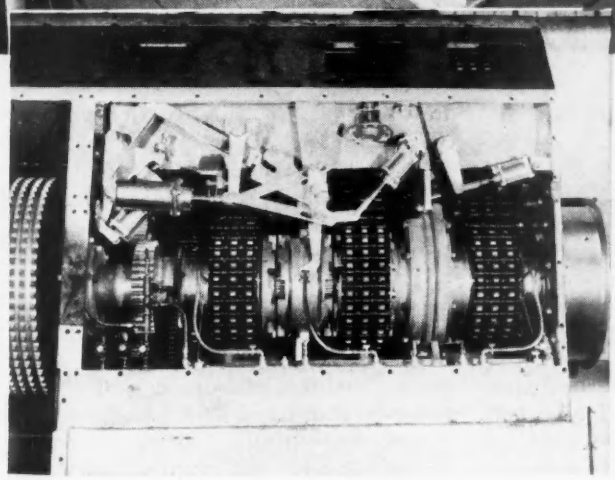
G. No. 1 engine driving drawworks. No. 2 engine driving No. 1 mud pump. No. 3 engine driving No. 2 mud pump. No. 4 engine down.

BELOW: View of compact control panel showing operational guide plate below the 3 short levers which control the power combinations for drives listed above. Over-riding weight for brake lever setting appears at floor level in front of pedals.



Brewster N-12 Drawworks needed HARNESS FOR 1600 HORSEPOWER!

BREWSTER N-12 DRAWORKS



LINK-BELT ROLLER CHAIN IS IT!

The transmission of this gigantic rig gives eight forward drum speeds and eight rotary speeds, but requires no more space than the conventional six speed job. Transmission uses Link-Belt 2″ pitch triple width roller chain on all forward speed drives.

Compound is equipped to drive two of the largest modern slush pumps through Link-Belt 1½″ pitch sextuple width roller chains to countershafts.

More than 70 years of chain improvements have made Link-Belt top performer among roller chains . . . and the choice of manufacturers and operators alike.

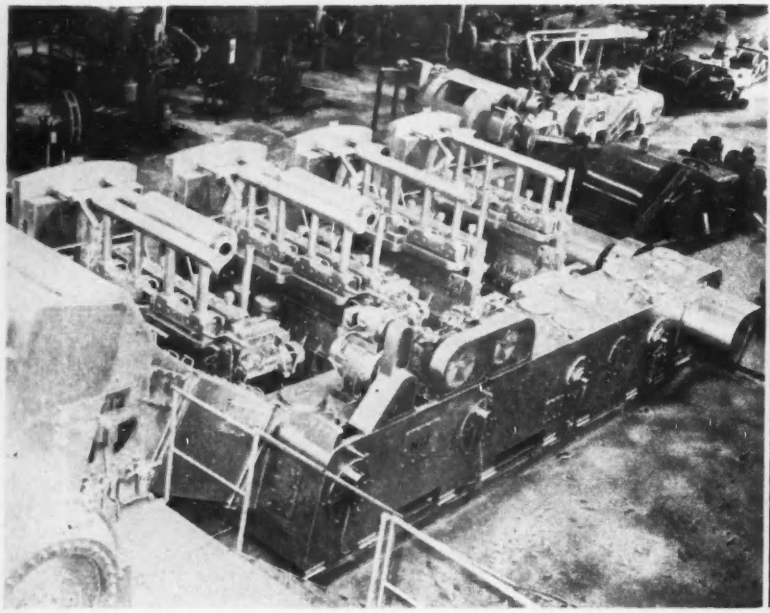
LINK-BELT

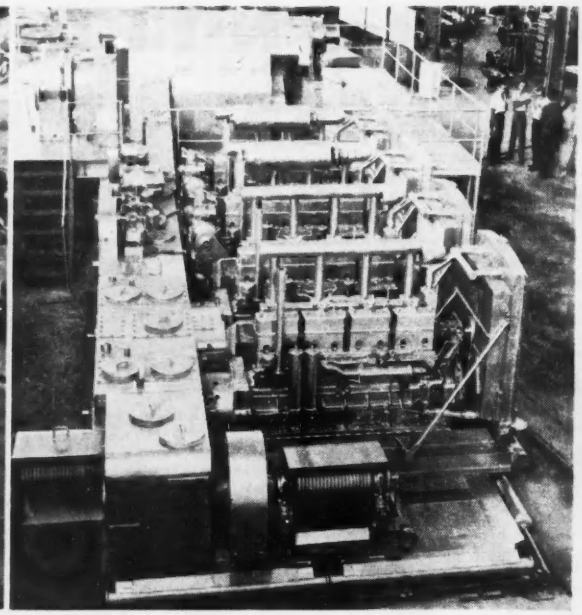
Precision Steel

ROLLER CHAIN

LINK-BELT COMPANY 12,085

Indianapolis 6, Dallas 1, Houston 1, Kansas City 8, Mo., Los Angeles 33, New York 7, Toronto 8.





LEFT. View from derrick floor of power units and transmission case. Only the chain housing and main drive chain need be disconnected when preparing drawworks for transfer. RIGHT. Showing the 2 pump drives, that for No. 1 pump being mounted on transmission case, with No. 2 pump sheave carried on stub jackshaft for ease in dismantling.

no rigid or universal-jointed rods are required to connect the floor control panel with the power-generating set-up. The control panel itself, with each operation clearly marked by a name or operation classification, consists of remote-control means for operating the 4 engines in any of the 7 different drive groupings illustrated by the 2-color drawings. Three valves, each having 2 positions, control the motors in the different operational arrangements as explained by the diagram and wording on the plate attached directly below the valve levers. Pressure gauges, in each case connected behind the clutch, indicate the air pressure actuating that clutch, and thus give positive indication of the functioning of that unit. Two short valve levers control the movement of the paired block clutches within the drawworks speed-change box, with a third providing control for the rotary table drive. Individual engine control settings permit the selective regulation of speed for any unit (for instance on mud pump drive) independently of the foot throttle which gives the driller control of speed on the engine or engines connected to the drawworks drive.

The brake lever is equipped with an adjustable chain- and sprocket-controlled weight which may be traversed on a second brake lever, mounted at floor level to remove it from position where it might be interfering with pedals or hand brake. This weight may be set so as to give any desired amount of weight and feedoff on the brake linkage, yet leave the hand lever clear and available for emergency control of drum speed. A quick-release trigger near the grip of the hand brake automatically returns the adjustable weight to the neutral or point-of-no-weight setting.

Auxiliary Equipment

The transmission case mounts a rig-light generator and a pair of air-compressor units. These are separately clutched and may be driven together or singly, as dictated by rig air requirements. Tanks mounted below the drawworks on the sub-base beams carry the reserve supply, from which radiate the leads to the various air-actuated units of the rig. Drives for the auxiliary equipment which extend above the top of the transmission case are housed and provided with ventilating louvers for admitting air to the fans built into the flywheels of the compressors and the end of the generator.

Provision for Rig Moves

Careful consideration of road clearance statutes and load limits appear throughout the design, although a unit of the capacity and depth rating of the N-12 normally would not be moved as frequently as a smaller rig. The drawworks may be set free from the power unit by disconnecting one chain, and by unbolting the chain drive housing at the edge of the drawworks base. Two flanged and bolted joints are used here, the one generally severed being perpendicular to the axis of the chain drive. This first joint is not made up rigidly, but incorporates a rubber seal ring or gasket which absorbs vibration which might be present either in rig floor or in the power skid assembly. Where breaking the chain guard at this point still fails to come within road clearance requirements, a second flange joint along the side of the drawworks shell may be broken by removing the cap screws holding the shield in place. This second operation brings the over-all width within the limits of the drawworks housing itself.

The power and transmission skid is composed of 2 units, each so designed as to form a rigid unit which will carry its superimposed equipment without elaborate underpinning or shoring. These longitudinal units, combining to form the operating base for the engines, may be separated by removing sets of easily accessible bolts. When divided, the entire transmission case forms a single unit, while the engine side of the base skid may carry small motors or be stripped of the 4 power units and then handled as a bare skid. The outer or No. 1 pump drive is fixed on a transmission skid which makes the over-all load width approximately 8 feet to come within rigid width limitations. The jackshaft carrying the grooved pulley for the No. 2 pump drive is detachable, but is designed to move on a motor sub-base.

IN THE NEW

BREWSTER N-12 RIG

W·A·B

Enginaired Controls

add SAFETY-EASE and SPEED to Drilling Operations

BREWSTER N-12 DRAWWORKS

In its new N-12 Rig—Brewster reinforces the modern features of this advanced equipment with the most modern and efficient controls.

Engine speed, clutches, rotary, pumps, and compounding are all controlled with maximum precision and minimum effort, through W·A·B Engin*aired* devices. The compact control stand occupies little space, places full command of every action within easy reach of the Driller.

Rugged, dependable W·A·B Controls provide the instant response and dependable operation that spells top performance on every location.

Westinghouse Air Brake Co.

INDUSTRIAL PRODUCTS DIVISION
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SAFETY TRAINING By Specific Practice Problems

Part 6

Derrick Structure Practices

By J. I. POWELL, Consultant

ONE of the oldest controversies connected with oil well drilling is whether it is safer to climb the derrick ladder or to ride the elevators in getting to and from the derrickman's work station.

Some companies believe ladder climbing is the safer and intend to remain firm in that opinion. Many have rigid safety rules that forbid the riding of elevators under any circumstances.

There are companies, however, whose managements evidently believe that elevator riding is just as safe as ladder climbing, and have a policy permitting derrickmen to ride elevators.

There is, of course, no real assurance that because a man climbs the ladder he will not fall. Likewise, there is no assurance that because a derrickman rides the elevators he will fall. There is considerably more to this age-old problem than a choice between 2 alternatives.

A study of the situation shows that there are more potential occasions for mishaps in riding elevators than in climbing ladders. While in the act of climbing a ladder, the climber himself is almost solely responsible for his own safety. There are, of course, exceptional circumstances which a climber, for various reasons, would not be able to foresee that could contribute to his falling.

A climber should be held responsible for observing any abnormal physical conditions of a ladder which could cause him to fall. For example, a rung may be off or the ladder itself may pull loose—pre-existing conditions that should be observed. A heavily ice-coated ladder makes it extremely dangerous for a derrickman either to ascend or descend a ladder. Derrickmen do, however, climb under those conditions without falling by employing utmost caution and skill.

A severe degree of fatigue, with numbness of hands and feet due to working several hours in a derrick on a cold day, can contribute to a man's falling from a ladder. Yet ladder climbing is being done safely under those conditions.

On the other hand, the derrickman who rides the elevators has to depend partially upon the driller's skill and thoughtfulness for his safety. Safety is dependent, too, upon the relative arrangement and use of certain pieces of equipment.

A rig-to-rig survey, detailed discussion with experienced drilling personnel, and a study of accident experiences, brought to light several revealing facts associated with the act of riding elevators.

It was found that the distances between the edges of monkey boards and center of elevators, while elevators were suspended adjacently, varied from 2 to 4 feet. Derrickmen who rode elevators where the maximum distance existed between elevators and monkey board, were usually assisted in their dismounting act. Floormen took hold of the elevators and pulled them and block assembly off center just as the driller started hoisting. With the derrickman on the elevators, the block assembly was hoisted, swinging pendulum fashion, up through derrick structure. The derrickman would ordinarily signal the driller when the elevator leveled with the monkey board. The derrickman would then time his step or leap from elevators to board when the space between board and elevators was at its minimum.

Such a procedure was once observed during a strong wind which was blowing into the face of the derrickman on the elevators. The usual act of pulling block assembly off center as it started up did not accomplish the desired result as the elevators leveled with board. The strong wind had lessened the arc of the swinging elevators. A wider distance than the derrickman was used to frightened him and he did not leave the elevators the first time they swung to make the minimum gap. He refrained from leaving the elevators on the second swing-in to board. The derrickman leaped across what appeared to be the full normal gap on the third swing-in, and by that time practically all the pendulum swing in block assembly was dissipated by the weight and wind.

The derrickman made the leap safely and without appearing to have been at the point of falling. The point is that he leaped that gap while about 85 feet above the derrick floor. His actions indicated his reluctance to make the leap over the progressively widening gap and against the strong wind. By spurring himself on with courage, he made the leap without disastrous results, but creditable records in preventing accidents are not attained by taking such chances.

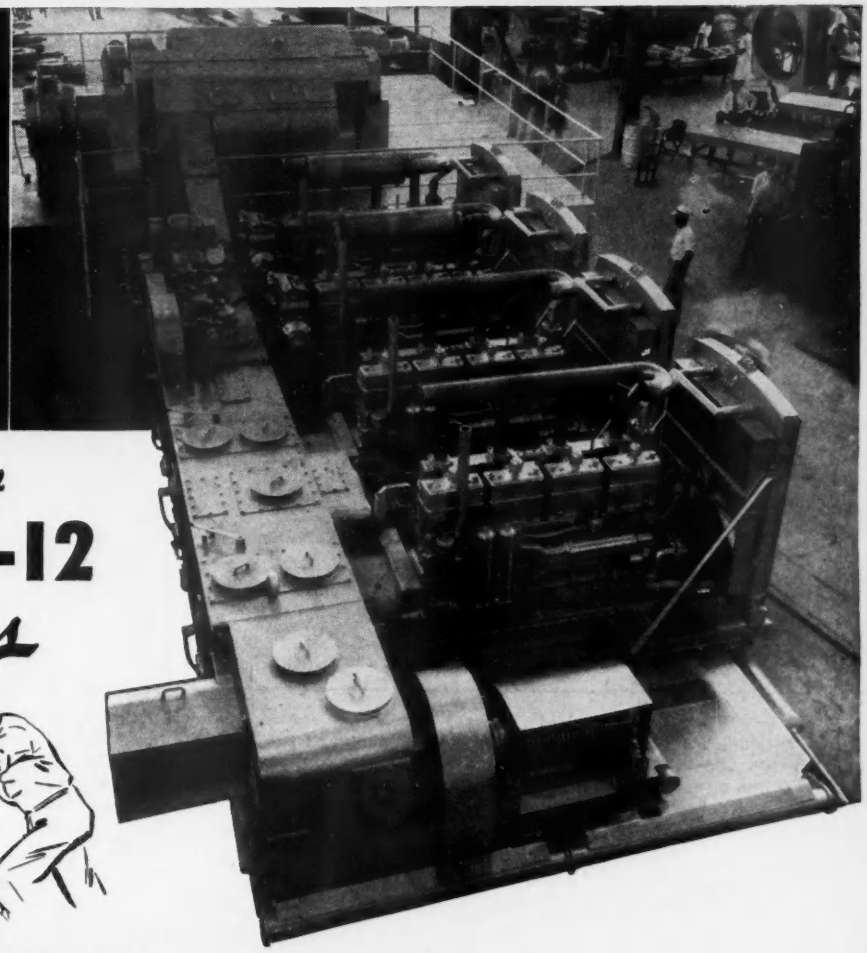
There was an incident wherein a derrickman nearly fell from the monkey board to the derrick floor. He left the floor, mounted on the elevators, with a grease gun tied into a loop of soft line. The loop was suspended across his left shoulder and the gun hung down about waist high below his right arm. As he started dismounting from elevators, he let the upper part of his body lean backward through the links in order to get momentum in making the leap to board. When he thrust his body forward, the grease gun, suspended from soft line, swung to the outside of elevator link. This happened at the instant he released his grasp on the links and his feet left the elevators. The friction

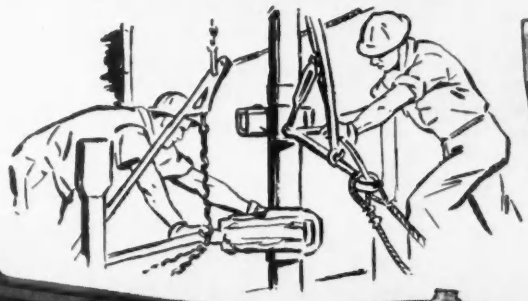
WITHOUT ATTEMPTING to solve the problem of whether to ride the elevators or climb the ladder, the author discusses accidents at the monkey-board level, and offers pertinent suggestions as to how they may be avoided. Other hazards of the derrickman's stand are also reviewed and improved practices recommended.

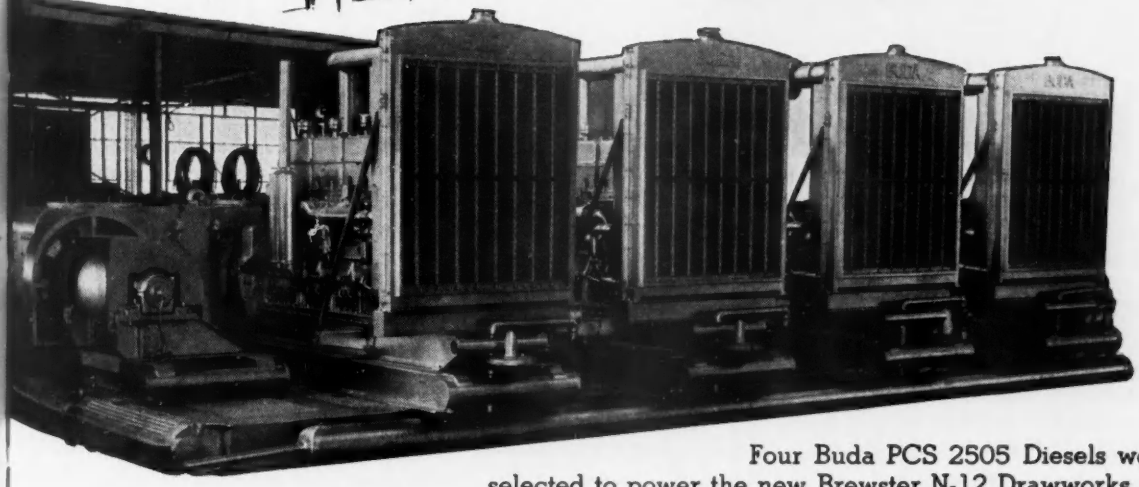
You see 4 BUDA engines ....Actually There are 12

on the New

Brewster N-12 *Drawworks*







Four Buda PCS 2505 Diesels were selected to power the new Brewster N-12 Drawworks . . . but Penrod Drilling Company got 12 engines instead of 4!

A new Buda development—the "Fuecomizer Package Kit" permits conversion of these Buda Diesels to Gas or Butane (or vice-versa) operation with minimum down-time. The Buda "Fuecomizer Kit" gives Penrod Drilling the chance to choose the most economical or more readily available fuel . . . Diesel, Gas or Butane . . . in effect, giving Penrod 3 engines for every 1 they have.

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a Power-full name in Engines... **BUDA**

BREWSTER N-12 DRAWWORKS

80-12

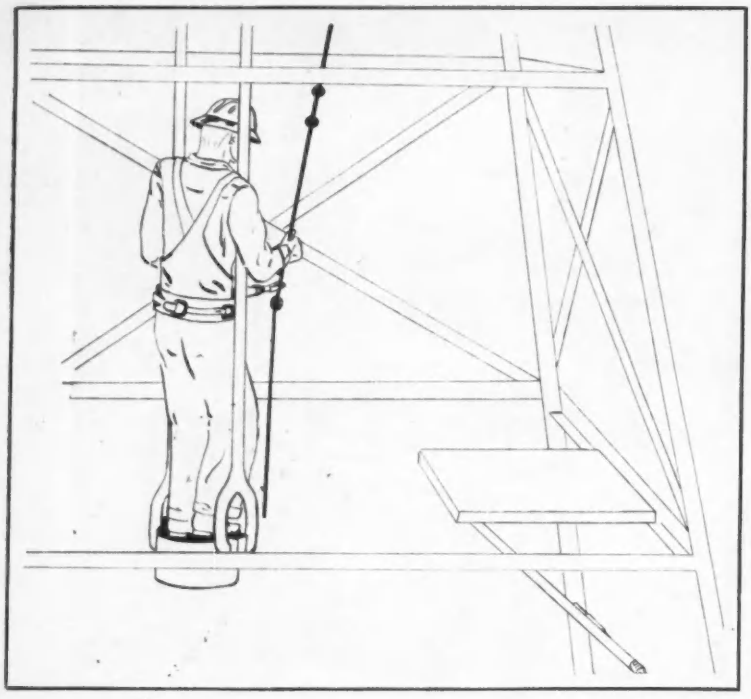


FIGURE 1. Derrickman can hook snap on his belt line to line above the lower of the stops, and can grip the line between the upper pair as he swings from the elevators toward the monkey board. In case of slip or missed footing the belt will be snubbed by the stop and a fall avoided.

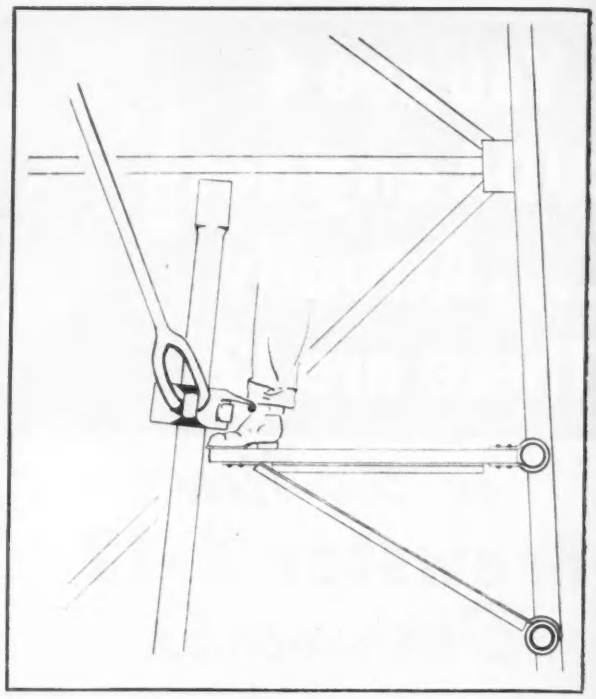


FIGURE 2. A short stand, and failure of the derrickman to unlatch the elevators before the driller had allowed them to begin their fall, resulted in a foot injury and—had the hook caught in the man's cuff or shoe—might have resulted in greater injury.

wrap of the soft line suspending the grease gun held well enough to check the derrickman's intended leap. The wrap then turned loose just in time to let the derrickman hit the monkey board with his chest.

The derrickman quickly grasped the edge of monkey board with his hands and secured himself against falling. After a desperate struggle he finally clambered onto the topside of board. In another case where a derrickman fell during the act of getting from elevators to board, it was found that he had a deep bruise beneath his chin. It was supposed that his chin hit the edge of board as his feet missed their mark and the impact momentarily stunned him so that he could not hold on with his hands.

A similar exposure to falling was present in both situations. One man was able to catch himself and clamber to safety; the other was not and he fell to his death.

There have been occasions where drillers have run the blocks into the crown and parted the drill line. One man told of his experience in jumping to an adjacent derrick girt and saving his life during such an incident.

Some members of the drilling supervisory department insist that when the derrickman rides the elevators he wear a safety belt and secure himself to elevator links with its tail line. In other words, as he starts up he should tie the line so that there will be sufficient slack to enable him to step or leap to board before untying himself from elevators.

A near fatality occurred in one drilling area through use of such an arrangement. The derrickman had been practicing this method of securing himself to elevators only a short while. The driller was forgetful and because of that he almost took the life of a man. The derrickman had just stepped over to the board. He was arranging his other safety belt when the tail line that was still tied to elevator link went taut. Because the tail line was attached to his safety belt, the derrickman was jerked from the board.

The driller had seen the derrickman step onto the board, but without remembering that the man was tied, he raised the brake lever and let the elevators start a fast descent. This thoughtlessness and the fact that a driller occasionally parts a drill line by running into the crown has discouraged many derrickmen from accepting the safety belt tail line attachment to elevator as an added safety feature.

It is not the purpose here to set down an opinion about which of the two alternatives—riding elevators or climbing the ladder—is the safer.

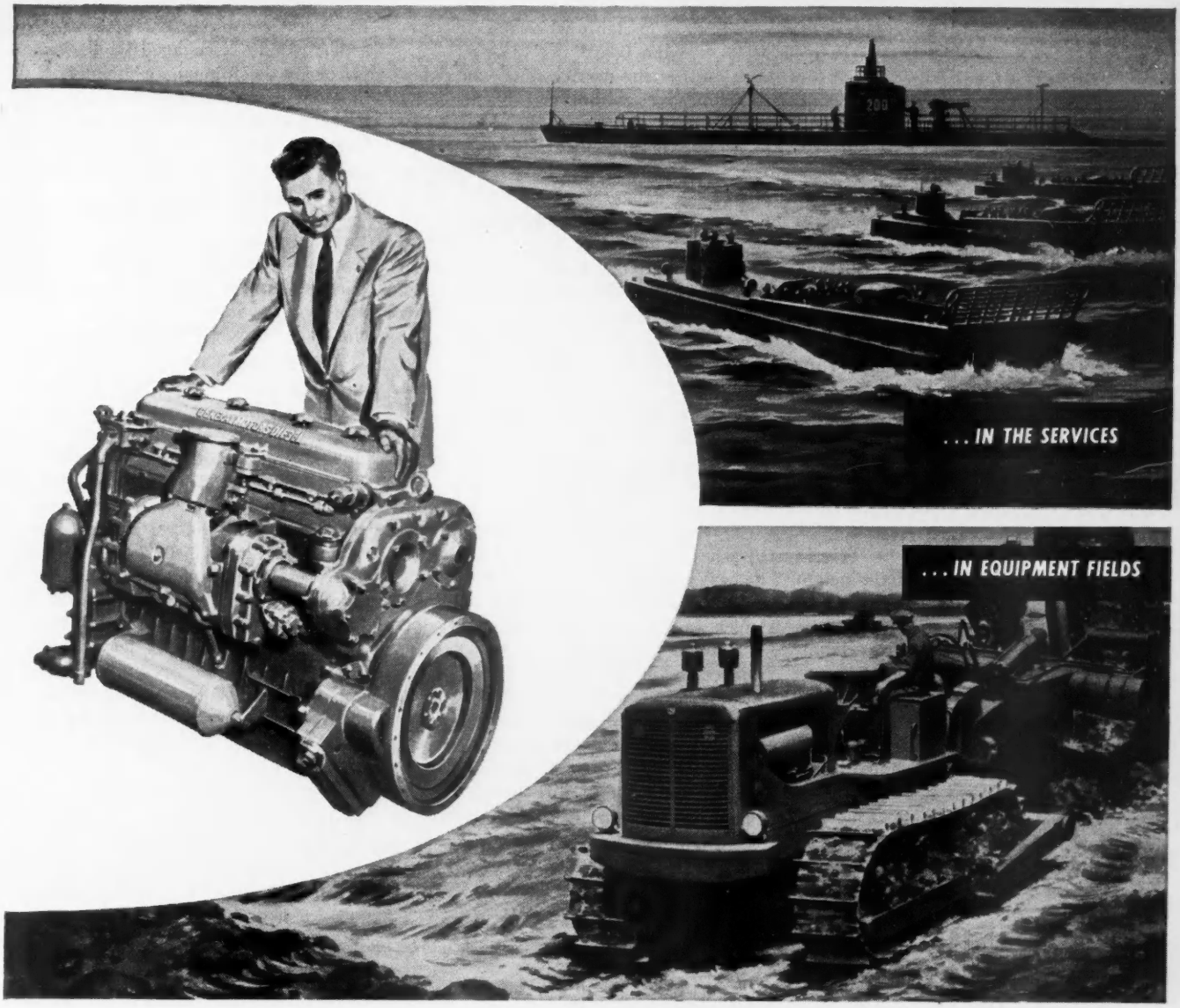
There likely will always be companies which will maintain that riding elevators is safe. The purpose then, in consideration of their opinion, is to do everything possible to encourage them to making elevator riding as safe as possible.

One important matter that should be worked out is that of establishing a standard distance for the gap between edge of monkey board and the center of elevators. The act of pulling the elevators and block assembly off center in order to effect a swinging motion as they travel up through derrick should be discontinued. Swinging blocks traveling up through derrick structure have contributed to serious and costly mishaps.

A derrickman may not feel at ease while attached to an elevator link with a safety belt tail line, and it is not believed wise to force a man to follow this practice against his will. He may be unduly frightened by the possibility of the driller's running the traveling block into the crown. He may have visions of a clutch sticking in or a throttle control coming loose. He may think about the driller's being forgetful enough to jerk him off the monkey board by letting the blocks down before he has time to untie the safety belt tail line.

Most old timers who have worked in the derrick maintain they would be safer if free to jump for "something" if anything abnormal occurred while riding on elevators.

There may be cases where a derrickman just slipped and fell out of elevators in upward or downward motion within



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GENERAL MOTORS

derrick structure. No such incidents are known by the author. In known cases there have been other contributing factors. In most instances the fall occurred while the derrickman was stepping or leaping either from elevators to board or board to elevators. These facts make it clear that this act is an exposure to danger which should be corrected.

One way of lessening this exposure would be to have what is termed a "landing cable" suspended from the water table to the derrick floor. This cable could be a ½-inch diameter soft lay cable. Special ball type clamps used on the body of the cable should be of a ball type design so as to eliminate sharp projections that might snag passing equipment.

One of the ball clamps should be attached to the landing cable at a height a little above the level of the monkey board. Two more should be spaced about 6 inches apart at about the height of a man's head when he is standing on the board. The bottom clamp serves as a safety stop clamp and the 2 top clamps as hand grips.

The derrickman who must ride the elevators should wear a safety belt to which is attached a short cable tail line. To the outer end of this tail line a heavy duty snap type harness hook should be attached. The derrickman does not attach himself to a link. The harness hook snaps onto the landing cable and above the safety stop clamp when the elevators level with the board.

A man on the derrick floor can swing the cable over within easy reach of the man on the elevators. The derrickman then attaches himself to cable and grasps the hand grip clamp to swing onto the board. The danger of slipping and falling from an icy or wet and muddy board is then minimized.

An additional clamp can be attached to this cable at a normal height where regular and temporary stabbing boards are used. The man who lands the board and arranges the rigging for a regular safety belt can use the temporary arrangement for his own safety.

An original study was made of 700 oil well drilling rig accidents. In order to break these accident experiences down into more closely associated groups, a report was made on the basis of what the crewman was doing when he was injured.

In the development of this particular paper only those accident experiences that were the result of a man's being injured while doing something within the derrick structure and above the rig floor were considered. It was found that 43 accident experiences out of the 700 over-all drilling rig accidents occurred within the derrick structure. Two of these 43 accidents, however, resulted in fatalities.

The "Derrickman's Work Station Practice" comprises all acts in which a derrickman is engaged while working on or in the immediate vicinity of the monkey board or thribble board. Accidents that occurred within this practice, however, were classified according to more specific acts or phases of the practice.

"Positioning Drill Pipe For Elevators" is considered a phase of the practice. Two accidents occurred within the performance of this particular phase. Both of the injuries sustained were to the back muscles.

"Positioning Drill Collars For Elevators" is category wherein 4 accidents occurred. One was a little unusual and could have produced serious results under slightly different circumstances. As the derrickman was guiding the drill collar stand out of its racked position, the pin end of the second collar up in the stand snapped in two. The upper portion of the collar stand fell to the floor. The derrickman was injured when the snatch block being used was torn from its fastening to derrick and in flying through the air hit his leg. Fortunate circumstances permitted the men on the floor during this mishap to escape from the falling drill collar stand section.

Drilling rig crewmen should be alerted to the possibility of such a mishap due to the pin threads crystallizing.

In one of the other injuries, a derrickman's finger was mangled when it was pulled into the sheave of snatch block being used to let the drill collar into position.

More thought should be directed toward selecting for such auxiliary use snatch blocks so guarded that it would be difficult for a man to thrust a finger between rope and sheave.

The other 2 injuries—one to a knee, the other to a back—were the result of excessive strain.

"Standing Drill Pipe Back" is a phase in which 3 accidents occurred. Wind blew out of the rack a stand which hit the derrickman's jaw and fractured it. Tie back ropes used by most derrickmen would have prevented this kind of accident.

Another derrickman lost his hold on a stand of pipe and it tilted across to the opposite side of derrick. Using the catline to pull it back, the derrickman got his hand caught between the stand being pulled and the other racked stands. The driller on the cathead below didn't know that and he kept pulling. The derrickman's hand was fractured.

Derrickmen should realize that it is difficult to get a signal from the monkey board to driller on the floor, either by voice or waving hand. The derrickman, therefore, during any similar act, should use the greatest caution in keeping his

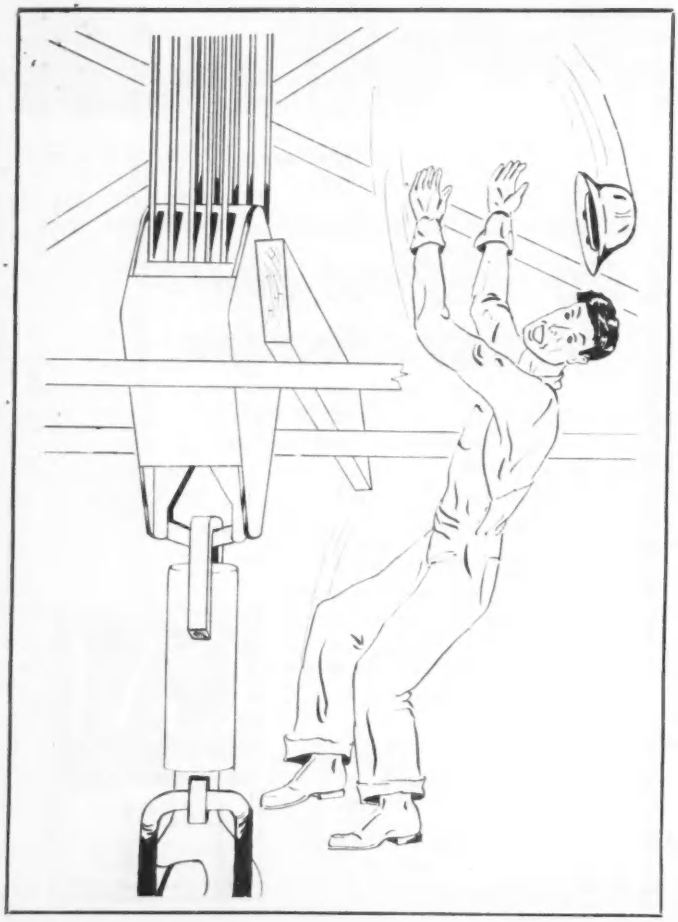

FIGURE 3. Combination of untied stabbing board, no safety belt — it was on its way up to the man on the board when the accident happened—and a swaying block resulted in an upset board and a serious fall for the man.

O'HARA LIMESTONE
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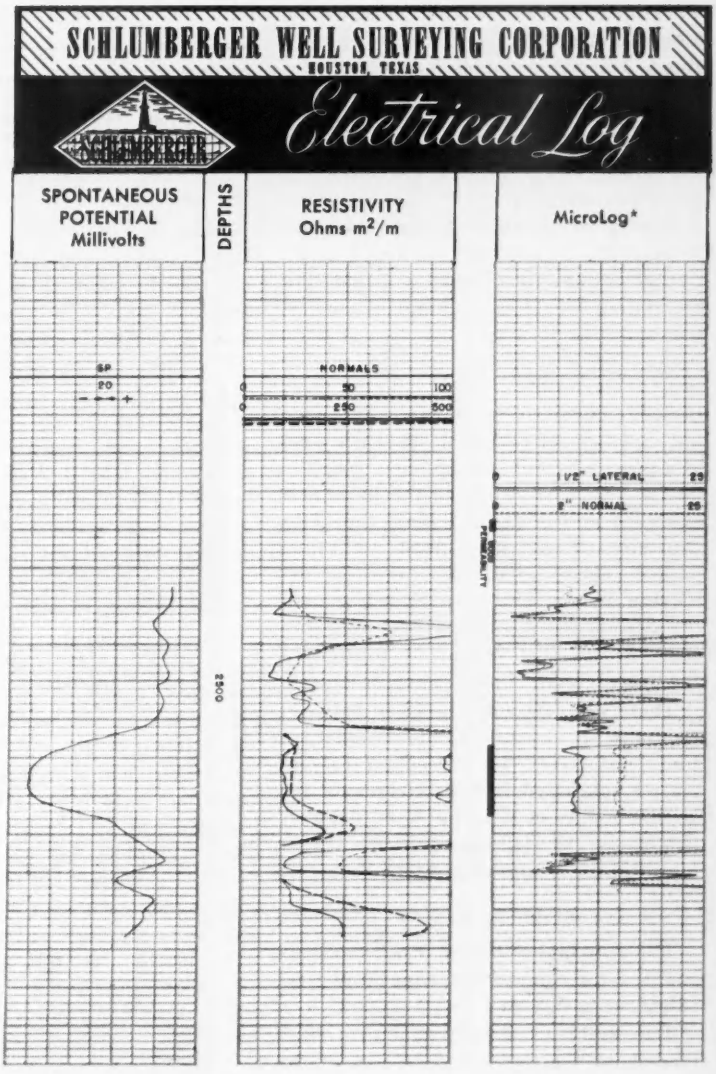
Mud (Aquagel): R_m 2.0 at BHT
Bit Size: 8¾"
Spacings: AM = 16"
AM' = 55"



LOG ANALYSIS

1) Water saturation S

R_w = 0.065 ohm — samples from adjacent wells
F = 35 — laboratory analysis from cores in adjacent wells
$R_o = FR_w$ = (35) (0.065) = 2.3 ohms
R_t = 125 ohms

$$S = \sqrt{\frac{2.3}{125}} = 13.6\%$$

2) Porosity p

$$p = \sqrt[m]{\frac{1}{F}} = 17\% \text{ for } m = 2$$

"MICROLOG" — indicates good permeability from 2516' to 2535'

CORE ANALYSIS

Average Porosity	17.4%
Average Water Saturation	20%

PRODUCTION RESULTS

Perforated: 2512' - 2535'
Potential: 2955 bbl/day after acidizing

*"MicroLog" is a trade mark of the Schlumberger Well Surveying Corp.

SCHLUMBERGER WELL SURVEYING CORP.
HOUSTON

members from between moving pieces of equipment.

The other accident in this group was a back injury.

"Standing Drill Collars Back" is a phase in which 3 accidents occurred. One of these was a shoulder muscle strain. Another finger was mangled as the derrickman let it go into the snatch block. A hook used on the pull-back line pulled loose, and while flying thorough the air hit the derrickman's leg.

The "Latching and Unlatching Elevator" phase of the practice involved 7 accidents. A derrickman was attempting to unlatch elevators from a stand of tubing that stood above the board only about 3 feet. He missed opening the latch and at the same time had the tubing pulled against the edge of board. The elevators continued sliding down the tubing where they hit and fractured the man's toe bones.

The safety measure to prevent such recurrences is to keep the stand sufficiently away from board so that the protruding elevators will not strike the board.

Another derrickman did not notice one of his tie-back ropes hanging over the edge of board, or that he was standing in a loop of that same tie back rope at a point where it was laying across the board. The wind whipped the loose and extended end of this tie back rope into the upward moving blocks as they passed. The rope became fouled in the moving block. The loop closed around the derrickman's ankle as the rope became taut; as it continued to tighten the man's ankle bones were fractured.

There were 2 thumbs mashed between the moving elevators and shoulder of tool joint boxes. In 1 accident foreign matter splattered in a derrickman's eye as the elevators hit the box. Another derrickman bruised his ribs while straining too hard against his safety belt.

Stabbing Boards

The "Stabbing Board Practices" accounted for 8 accidents. One injury resulted in a fatality.

The stabbing board had just been landed on the derrick girts and in the position to commence stabbing casing. The stabber was on the board waiting for his safety belt to be sent up to him on the traveling hook. The driller started hoisting his belt. The wind was blowing and the outside nut on the sheave shaft of the block caught the edge of the stabbing board. The board was tilted and the stabber's feet slid off the board. As he fell his feet glanced the bail of the swivel which, in turn, caused his head to go down first. His head collided with the rotary.

That man's life could have been spared through a corrected procedure in rigging to run casing. No part of the hoisting equipment should be run past an untied stabbing board when a man standing on it is not secured by a safety belt.

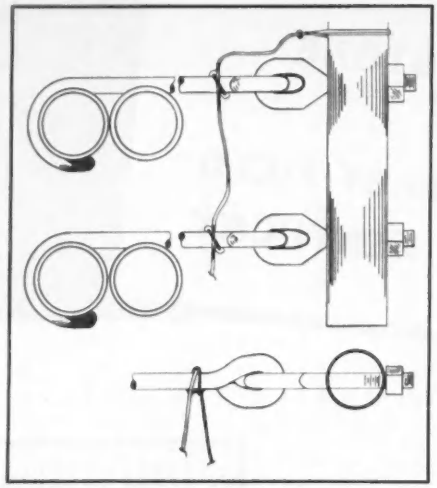


FIGURE 4. Method suggested for attaching safety cable to pipe-racking hooks outside the knuckle joint. In case of failure of the joint or retaining bolt the line will snub the released part, preventing its fall to the floor below.

The difference between a tied stabbing board and a man with a safety belt in comparison with the above arrangement and procedure can be illustrated by a similar incident. The open door of a casing elevator caught beneath and broke the stabbing board in two in its upward motion. The stabber fell to the stretched-out length of his tail line. His lower chest area was bruised.

Another man met with fortunate circumstances when he fell off a temporary stabbing board. A temporary stabbing board was so placed that the kelly could be stabbed on the upward extended end of drill string. The bit had encountered a bridge before the stand could be let all the way into the hole. This stabber was bumping tongs on the tool joint when he missed his intended mark. As the momentum of his continued swing spun him around, his foot slipped off the board. He fell against the tong equalizing line and instantly grabbed the line as he fell toward derrick floor. He was able to check his fall sufficiently to avoid serious injury. Had he missed that line, the result would have, without a doubt, been a great deal more serious.

The only safe way to work on a stabbing board is to be properly secured with a safety belt rigging arrangement.

The other 5 stabbing board accidents involved mashed fingers caught between board and girt of derrick during the stabbing board landing act.

Riding and Climbing

During the attempted act of dismounting from elevators and mounting monkey board in derrick, a derrickman failed to secure himself on the board. He fell from the height of the monkey board to the derrick floor and was fatally injured.

Another derrickman, while dismounting from elevator onto the derrick floor while elevators were just above floor level, hit his knee against the extended end of drill string in rotary.

In climbing the derrick ladder, a derrickman was carrying a nail bar in one hand. The bar almost slipped from his grasp. In a surging effort to catch the bar, he struck his thumb against a ladder rung and badly sprained his thumb.

Two employes were injured when guiding traveling hook into swivel bail. Both were suspended in looped and tied ends of the catline. One sustained a chest injury, the other a mangled finger when caught between the moving bail and a stationary part of the swivel.

There was one eye injury due to a sheared fragment from a hammer blow while repairing locking device on hook.

In refastening guard to traveling block, the guard was dropped onto one of the crewmen.

During the act of stringing drill line through crown block, 2 crewmen had a finger each badly mangled. One crewman injured himself in aligning crown with a pry bar. The bar slipped and hit him in the rib area. Another man strained his back in handling a jack.

Miscellaneous

The failure of derrick-mounted equipment figured in only 1 serious accident out of the 700 over-all drilling rig accidents studied. The piece of equipment that failed was a pipe racking hook. This particular hook had a knuckle joint and an extended piece of round bar stock from that passed through a piece of 4-inch pipe. The section of the hook that went through the pipe fractured under stress and as the pieces parted, the hook section fell toward the floor and struck a crewman on the head.

Subsequent investigation determined that the short knuckle section had been partly cut in two with a hacksaw blade. It was presumed that it was that way when it was being shop-made into a hook. The cut was filled with grease and grit; hence, it would have been difficult to observe.

These racking hooks should be provided with a safety cable. In the event the threads stripped or an eye of one of the knuckles opened or parted, the cable would prevent the hook from falling to floor.

There were 4 other miscellaneous practice accidents. A back was injured while rigging the drill line guide; another back strained while rigging the slinging down trolley weight. Two crewmen mashed their fingers severely between racking hook fingers and derrick girts during the rigging procedure.

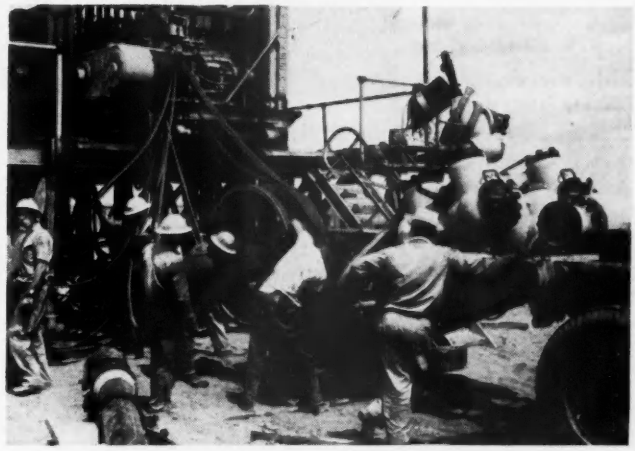
How to do it!

DRILLING HINTS

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.

HOW TO—Install V-Belts on Power Pumps

A time-saving method of installing V-belts on a heavy duty power-driven mud pump makes it easy to place tension in the belts without the aid of jacks. This method is in contrast to placing the pump on the ground close enough to the rig so the belts can easily be placed in their matching grooves, then jacking the pump away to put tension in the belts.



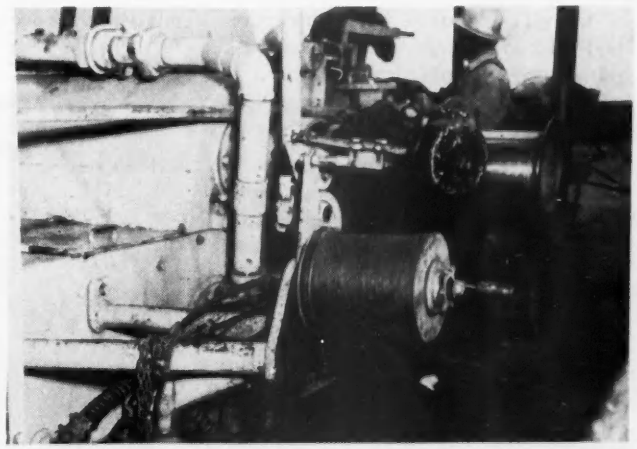
The V-belts in this instance are placed in matching grooves on the large pump pulley during installation of the pump. The power end of the pump is lowered on heavy timber from the transporting truck at extreme right. The fluid end of the pump remains tilted as shown until all belts are in place.

The pump may be positioned exactly by using the winch line on the truck or by additional winching from a helper truck to adjust the pump's position parallel to the edge of the engine substructure.

Once in the desired position, and all belts in place, the fluid end is carefully lowered to ground level by the truck winch. As the pump is lowered to a horizontal position, the large V-belt pulley swings away from the pump drive and the belts begin to tighten. When the pump is resting upon heavy timber in a horizontal position, the belts are tight and the pump can be blocked so it will remain at a fixed distance from the engine substructure and from the V-belt driving pulley.

HOW TO—Improve Wire Line Reel Mounting

In the hard rock country where straight-hole drilling requires close observation of hole direction and countermeasures when deviation exceeds allowable angles, it is frequently necessary to run directional surveys. The wire line measuring reel then becomes an important item, and must be located in a convenient place for speed in running. The location of the measuring reel in the case illustrated and the manner in which it is mounted has proven practical.



The reel itself, together with the measuring sprockets and line tension counterbalance, is supported by a triangular plate of 1-inch steel. To this heavy steel plate are welded 3 legs of 2-inch pipe which are bolted to the housing of the drawworks transmission. Two of these legs are horizontal, and lend support in a forward and backward direction, while a third leg is an angular vertical brace which serves as a weight support as well as to aid in firmly anchoring the measuring reel.

The reel is placed at such a distance from the transmission housing so as to line up the V-belt pulley of the reel with the cathead shown in the background. By wrapping the V-belt around the cathead and into the V-belt grooves, the cathead can be used to power the measuring reel when coming out of the hole with a directional shot. The reel is far enough behind the cathead to offer no interference to the cathead operator, and remains in place during rig moves.

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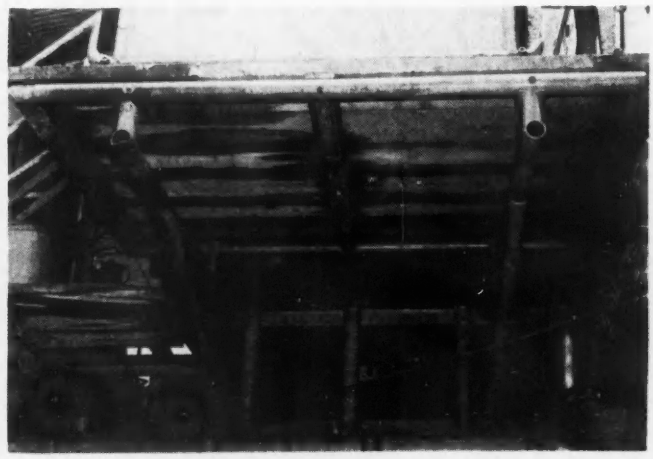
HOW TO—Extend Rig Floor Level



Engines are placed about 30 inches below the derrick floor level in the substructure of this West Texas jackknife rig. A short, heavily reinforced superstructure rests on the engine substructure to support part of the drawworks and the power transmission.

This pipe framework supports the tool bench on a level with the floor, but outside the derrick. The tool bench is on the driller's side of the drawworks and behind him. It consists merely of 2 cantilever beams bolted in a horizontal plane to the upper beam of the drawworks superstructure. Two 3-inch angular pipe braces are bolted to the lower beam of the superstructure as shown.

Additional height is gained by welding 4 vertical legs to the cantilever beams and then welding to the top of these vertical supports a rectangular framework of 3-inch piping. Heavy 3-inch planking laid across this framework serves as decking on which the tool bench is placed. Weight of the tool bench is not excessive, and this framework can be transported as one piece.

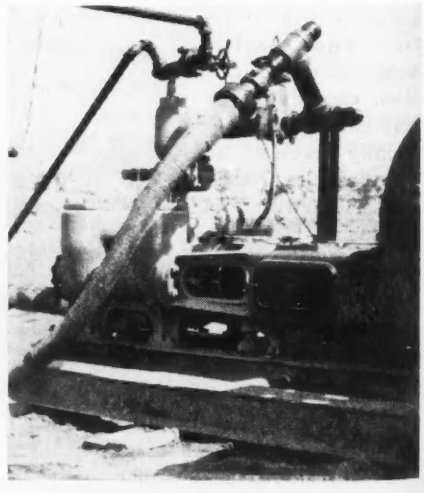
HOW TO—Connect Discharge Lines

The use of rubber discharge hose and convenient piping arrangements has greatly speeded up the job of tearing down a rig, moving it and setting it up again. This moving time is further reduced by skidding rigs in the West Texas area, but even so, the mud pumps are moved separately. The connections illustrated are simple, but embody several useful and practical ideas.

When using rubber hose for the mud pump discharge, sharp bends in the hose must be avoided. By directing the connecting union downward as shown, extra piping and fittings are eliminated. Two tees and a supporting leg make this arrangement possible.

The mud discharge line comes directly outward from the pump surge chamber where a short 3-inch nipple connects to a mud valve. Another short nipple and a tee direct the line upward at an angle and connect through a third nipple to a second tee which is attached to a swage nipple and a hammer union. These fittings are supported by a vertical leg which rests on the mud pump housing. Purpose of this leg is to remove any strain from the horizontal line extending from the surge chamber.

The discharge hose is quickly removed by breaking out the hammer union, while the other connections are left intact for moving. Mud gun lines and mixing lines are shown attached to the top of the surge chamber.



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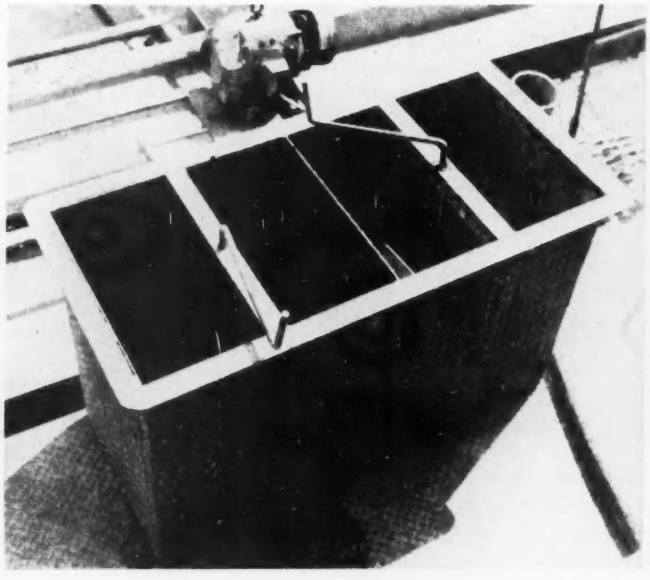
J&L STEEL

HOW TO—Construct Chemical Tank



A 2-cylinder chemical tank for adding treating material to drilling fluids can be constructed for mounting just off the derrick floor of small drilling rigs. The tank illustrated is made of floor plate, but may be made from other types of plate steel as well. Measuring about 28 inches wide, 4 feet high and 5 feet long, the tank is divided in half with a welded steel wall. A piece of angle iron welded across the middle of each compartment at the top contains a bushing through which a steel rod fits to actuate a stirring paddle at the bottom of the tank.

The lower end of the rod is held in the vertical position by a second cross brace near the paddle, which is a flat piece of sheet metal with holes in each end. The rod is bent at the top to form a crank to stir the contents of the tank when water is added.

The tank rests on a small platform adjacent to the derrick floor on the driller's side of the rig, and it also supports other mud testing and treating apparatus. The complete platform straddles the mud return line which discharges into the shale shaker just beyond the chemical tanks. The treating chemicals are added in desired quantities before the mud reaches the shakers so that they are thoroughly mixed by the time the mud flows to the mud pits. The chemical tank is relatively small and is fitted with two drains at the bottom so the flow of chemicals into the mud collecting box of the shaker can be controlled by a gate valve.

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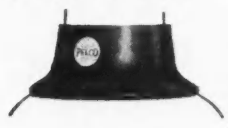
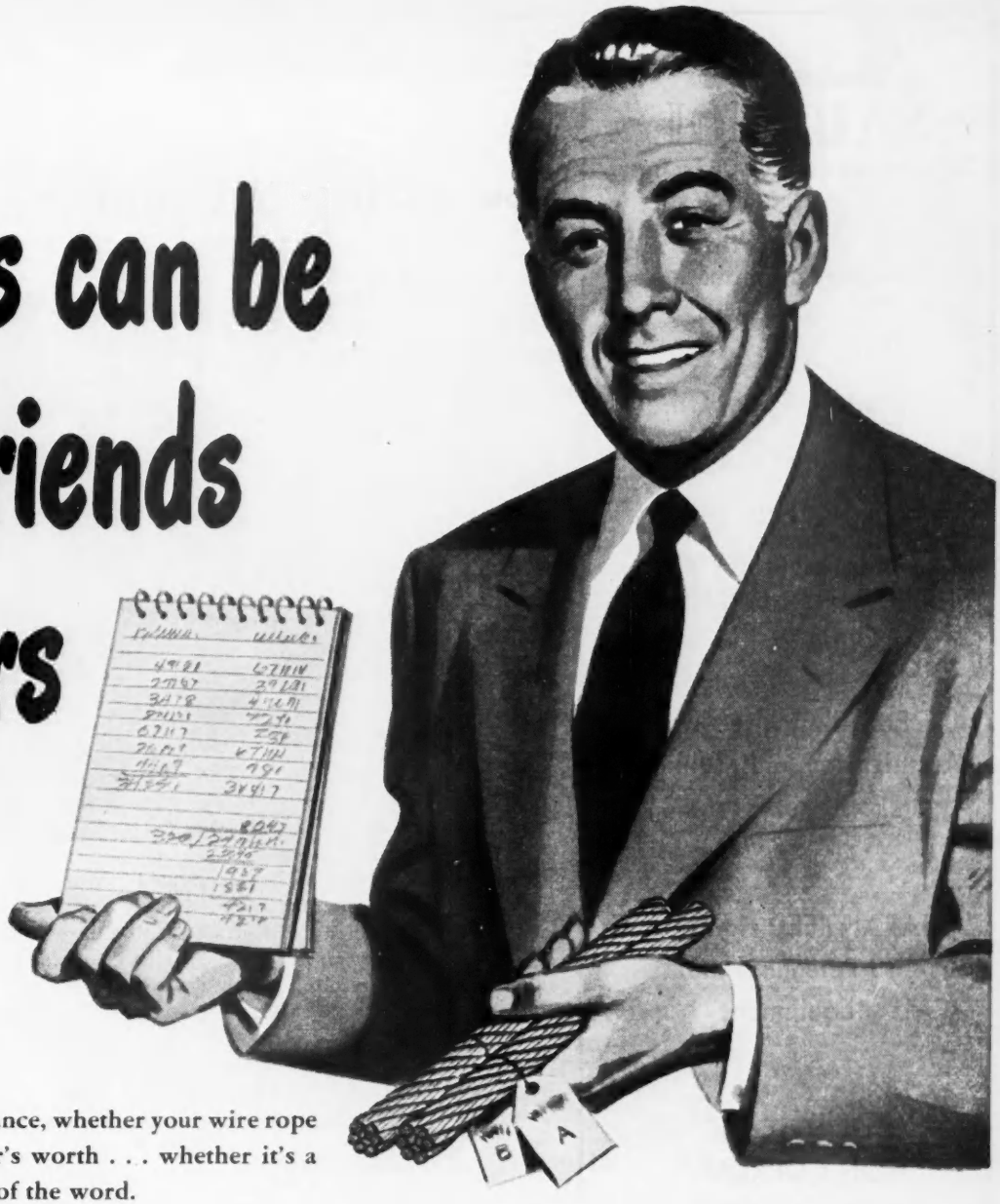


Be sure to check the *Trading Post*, page 340

Figures can be good friends of yours



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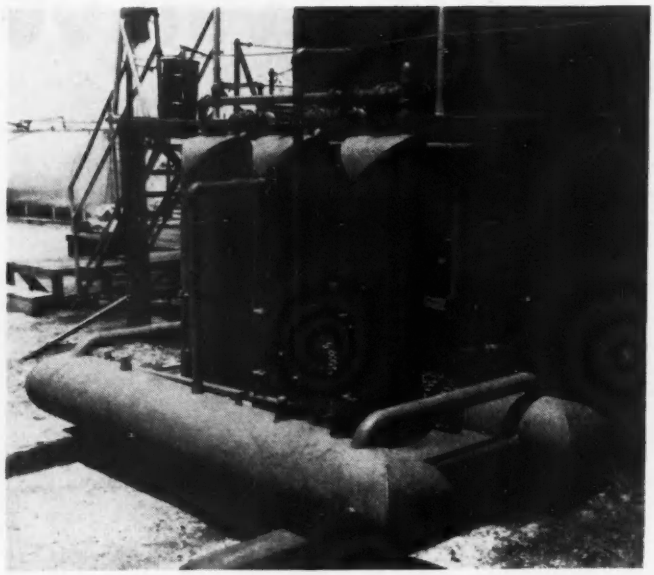
HOW TO—Build Combination Tank



When using field gas as fuel for drilling rigs, and particularly when this field gas is used in gas engines, it is necessary that any slugs of liquid hydrocarbons or scale and dirt be removed prior to burning the gas in the engine.

Here is a triple-tower gas scrubber unit combined with volume tanks which serve as skids for the entire unit. Gas coming into the well location is taken off the gas line on the separator, and has to be reduced in pressure. All vessels shown were fabricated from 16-inch outside diameter casing, with both ends sealed as illustrated. All 3 vertical vessels are scrubbers partially filled with light diesel oil which absorbs for slugs of condensate that might pass through the line.

The two outer vertical tanks are connected by a 2-inch line across the top that forms a common header for incoming field gas. This header is equipped with valves so either of the 2 outside chambers may be by-passed in the scrubbing process if more oil is added, or the scrubbing oil changed.

The vertical run of 2-inch pipe carries the gas to the bottom of each vertical where the gas bubbles through the oil to reach the top. Here the gas is piped over to the top of the middle scrubber vessel and again conducted to the bottom of the tank. The gas bubbles up through the oil and is taken off at the top and piped into the volume chambers which form the horizontal skid members. The distance between both volume tanks is about 7 feet and the 2 vessels are joined structurally by cross members welded. Both vessels are connected by 3-inch equalizing lines at each end of the unit. Fuel lines to each engine are connected to collars welded to the top side of the volume tank in the background. Each line is fitted with a regulator to reduce pressure to operating values. These engine fuel lines are flexible hoses, and the job of setting up the unit requires little time since its location is not critical.

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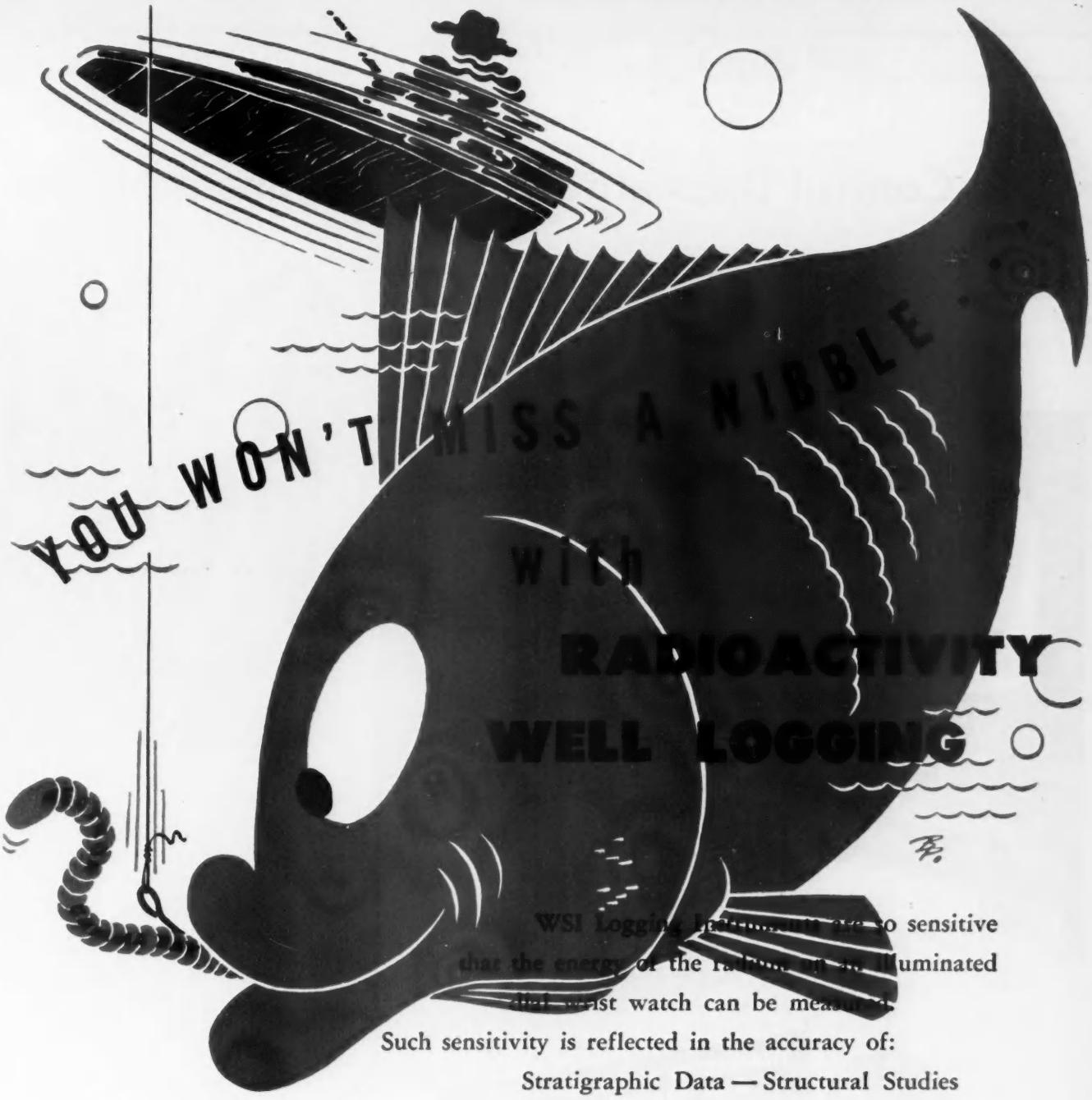

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HOW TO—Control Discharge Fluid from Shale Shaker

In drilling deep wells in the Permian Basin of West Texas, it is sometimes necessary to discard the fluid in a mud system to change over to another fluid, to discard contaminated slugs in the system, or even remove the fluid prior to moving the rig. Instead of a complicated valve control manifold to direct the flow of drilling fluid from the shale shaker into the settling tanks or into the shale pits, one contractor fabricated this practical and inexpensive flow control.

Clean drilling fluid discharging from the shale shaker flows through a 10¾-inch pipe directed into the settling tank at a 45-degree angle. Just below the bend in this discharge line is a horizontal pipe that extends well into the shale pit.

Into each pipe is a slot about 1 inch wide and 18 inches from the juncture of the 2 lines, cut at right angles to the longitudinal axis of the pipe. A flat hollow channel guide is welded in each slot as shown. The guide is made of 2 pieces of ⅛-inch plate steel welded together at the edges so that they are separated by about ¼ inch. Width of the guide is approximately 8 inches.

The guides are open inside the pipes that fluid can flow through them. A shut-off plate of ⅛-inch steel plate, and of such a size so as to fit easily into the guide slot welded to the lines, serves as a valve to shut the flow of drilling fluid from one branch of the shale shaker discharge line into the other. The change in direction of flow is made by inserting the blank plate in the line to be closed.

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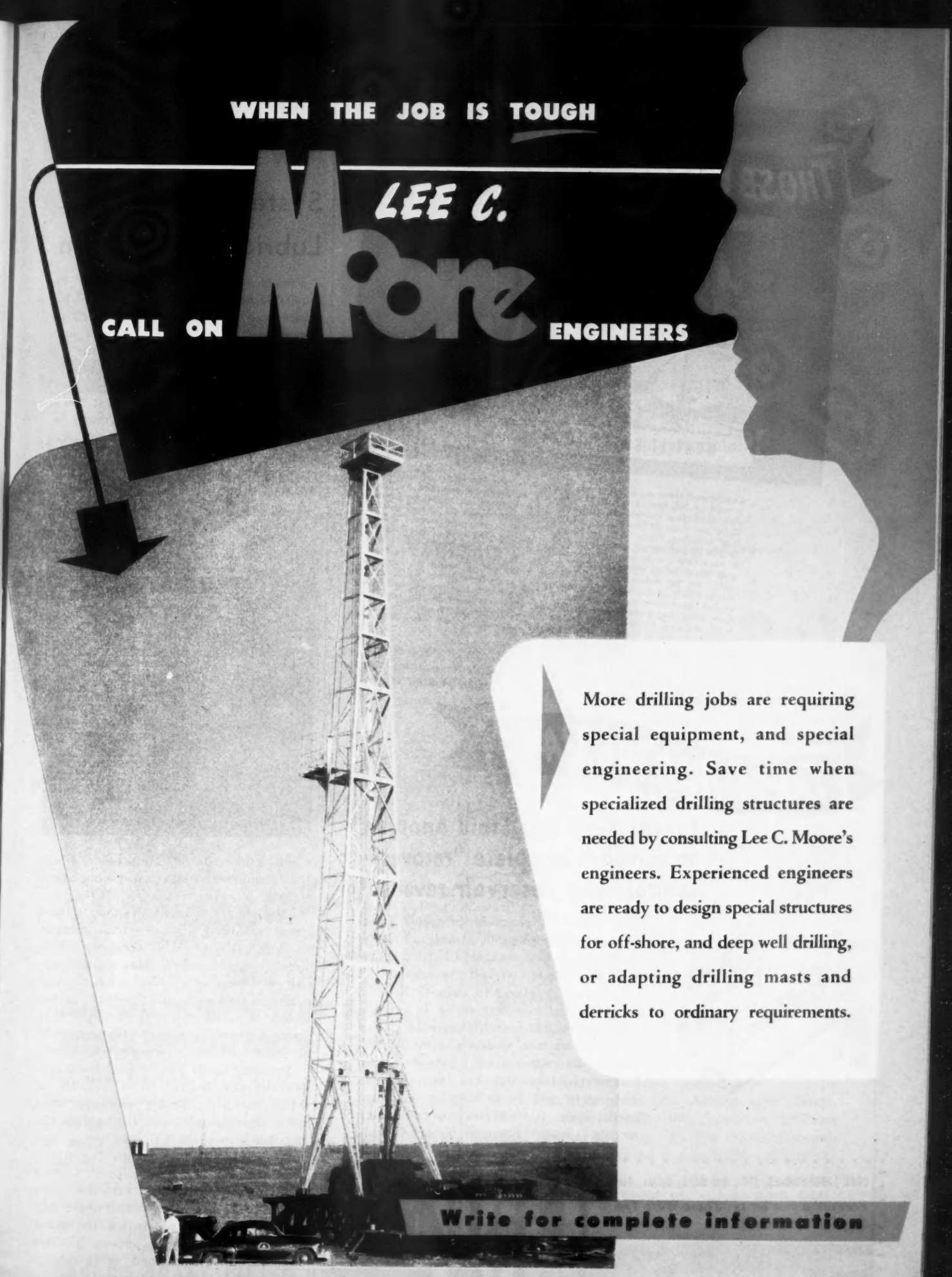

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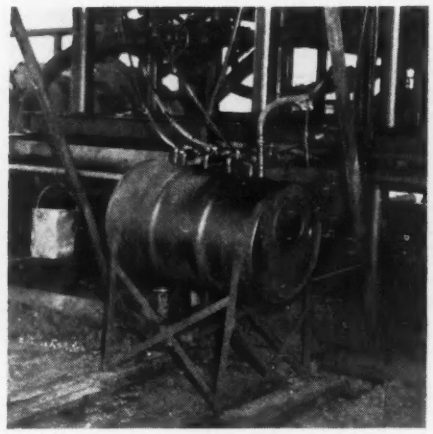
HOW TO—

Systemize Drilling Lubrication Program

Proper lubrication programs are responsible in large part to the added life which can be obtained from drilling equipment. By providing facilities adequate to do this job properly, the rig owner assured of better lubrication of his equipment.

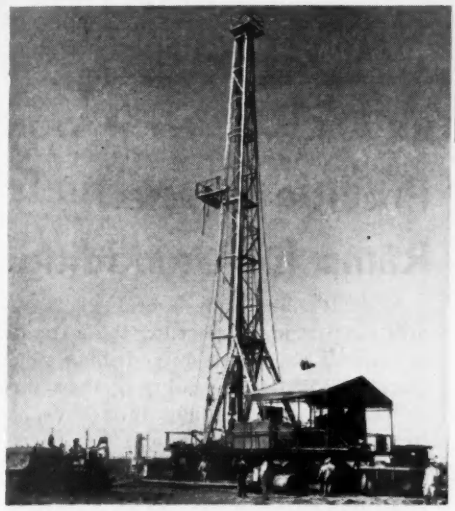
An idea employed on one West Texas medium-depth power rig has greatly facilitated proper lubrication and greasing of drawworks, power transmission and engines. It consists of a heavy 55-gallon drum with 6 1-inch collars welded to the top side of the drum when placed in a horizontal position as shown. These collars are fitted with short nipples and



ells to connect to flexible pressure hoses that terminate at strategic points about the rig.

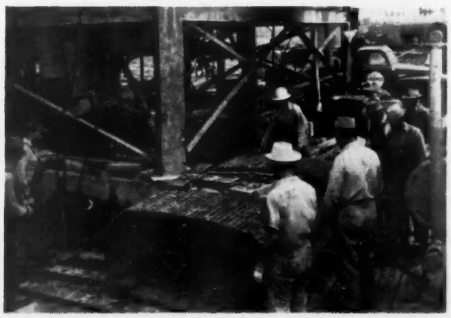
This container is an ordinary grease drum equipped with a small circular opening at one end through which grease may be taken. This same opening was used as a filling door through which additional quantities of grease could be poured as the supply was used. This door was made pressure tight to withstand 25 or 30 pounds pressure.

Pressure could be provided from several different sources on the rig. In the case illustrated, butane gas was used as a standby fuel, and it supplied the necessary pressure to force the grease through the lines and into the equipment. A 2-inch line equipped with a regulator was connected into the opposite end of the drum at the upper section in order to pressurize the space above the grease with butane. The six grease outlets contained short nipples that extended down into the grease so that no butane was exhausted with the grease. Compressed air could be used.



Jackknife derrick being moved at Pierce Junction.

Close-up showing jacks in position on derrick moved at Winnie, Texas.



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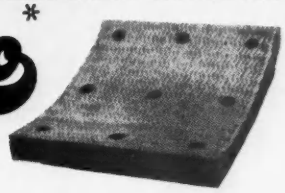

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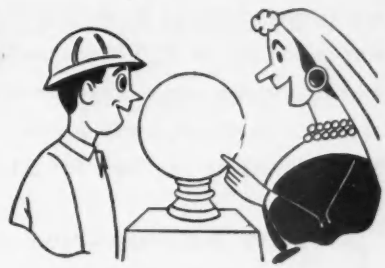

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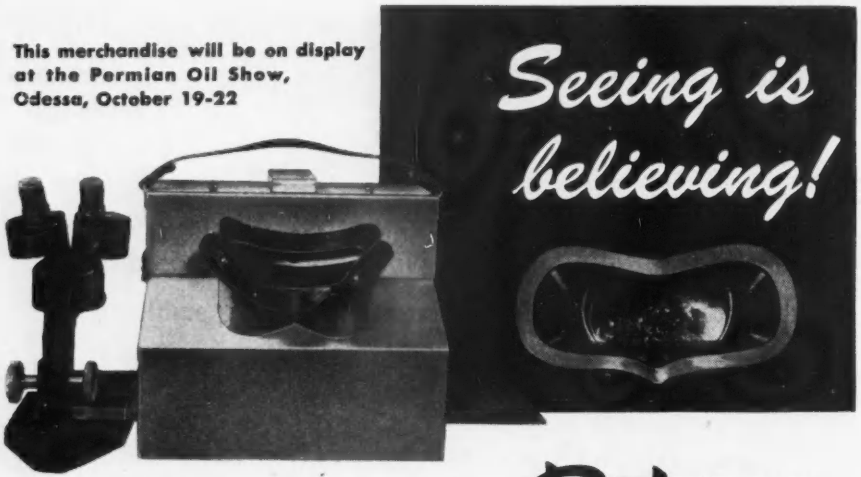

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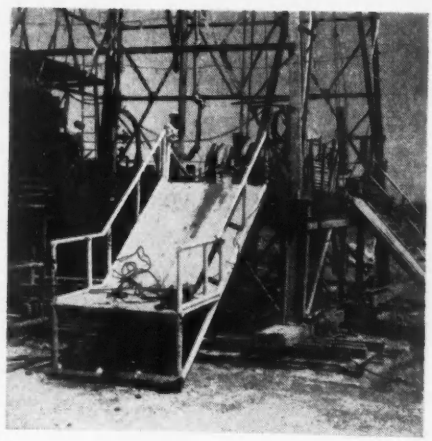
HOW TO—

Provide Special Ramp for Unloading

A drill collar and several joints of drill pipe frequently occupy the V-ramp or catwalk on heavy-duty drilling rigs, thereby reducing the utility of the ramp or catwalk for handling miscellaneous items. It is not uncommon for parts,



bits and other supplies trucked out to the rig to be dumped on the ground.

A special unloading ramp installed at right angles to the vee ramp permits these miscellaneous rig floor items to be unloaded from the transporting vehicle onto the auxiliary ramp and from there hoisted to the floor by the catline. Illustrated is an integral ramp of salvaged 4½-inch drill pipe and 3-inch pipe. The supporting framework is of the larger and heavier drill pipe. The upper ends of the angular beams rest on the edge of the derrick floor, while the lower ends are welded to a cross piece resting upon the ground.

A horizontal platform extends about 48 inches above the ground to provide convenient unloading or loading of heavier pieces. The entire surface of the auxiliary ramp is covered with heavy steel plate. A 3-inch railing was welded on both sides of the ramp to prevent equipment from sliding off the ramp as it is pulled up the ramp and onto the derrick floor.

The complete ramp is about 8 feet wide and is a solid all-welded unit. There is nothing to bolt together and it can be quickly set up in position or removed. Because the ramp has no protruding members on the bottom, transporting it from one location to another is facilitated. The bottom rests flat on the truck bed, and other pieces of equipment can be placed on it during rig moves.

HOW TO—

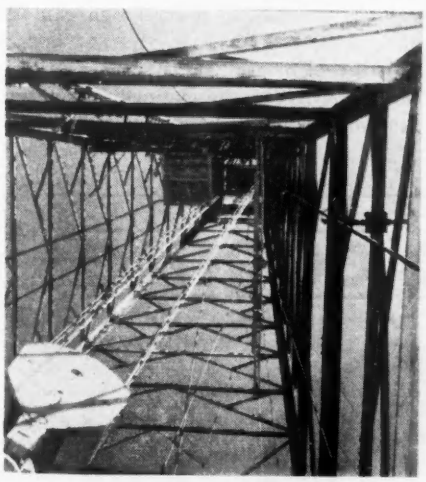
Shorten Pipe Tong Counterweight Lines

On many API derricks it is common practice to run the steel cables that support the heavy pipe tongs all the way up to the water table where a small sheave is bolted. The cable then passes downward and below the derrick floor where it is attached to the counterweight.

The device illustrated appreciably shortens the length of counterbalance cable required for the 136-foot derrick, or other sizes of API derricks. A steel beam spans the fifth girt of the derrick, and the counterbalance line sheaves are attached to this beam as shown.

The beam is actually 2 pieces of 4-inch channel iron welded together on bottom and top with metal tabs so that the channels face each other. Bolt holes are drilled through the lower part of the channel and the eye of the sheave is lined up with these holes so that a bolt securely mounts the wire line sheave.

The beam is attached to the fifth girt by U-bolts that pass through the flanges



of each channel iron, around the girt on which the beam rests and bolt in the facing flange. Not only are both heavy pipe tongs supported by this spanning beam, but the drill pipe mud box are held up by it. Return counterbalance lines pass through the floor and adequate counterbalance weights are added to the end of the steel cables.

By shifting the fabricated beam on the supporting girt, the pipe tongs may be placed at the desired position in relations to the rotary. Integral construction of the beam makes it easy and convenient to transport from one location to another.

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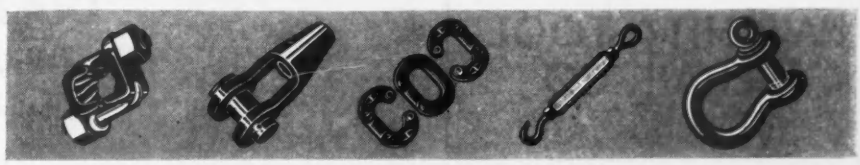

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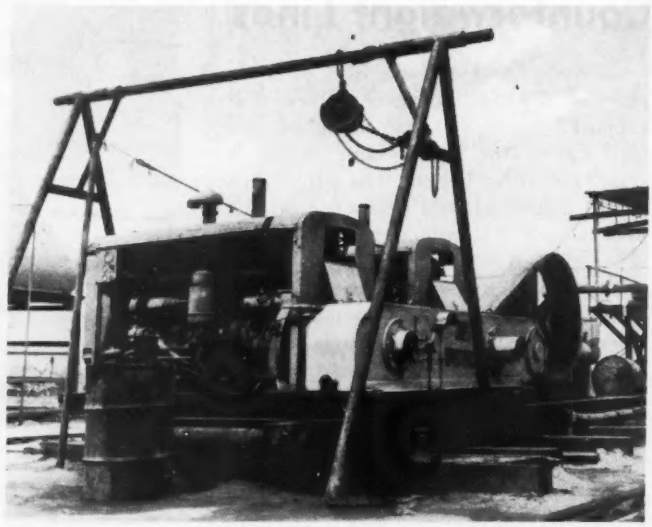
HOW TO—Service Heavy Engines



Servicing heavy-duty engines in the field is always a problem due to lack of adequate facilities. It is sometimes necessary to truck the engine to the shop for repairs.

A highly-portable hoist has greatly facilitated the repair and overhaul of big engines. Two large engines are combined through a transmission drive to power the standby mud pump. Air clutches make it possible to engage or disengage either engine while the other continues to drive the pump.

The chain hoist support is a heavy A-frame of salvaged 4½-inch drill pipe. Apex of each end frame member extends about 10 feet above ground. The legs are reinforced near the upper end with a cross piece which serves as a supporting base for an angle brace welded to a short section of 5-inch pipe as shown.

A heavy piece of 4½-inch drill pipe, long enough to span the engine setting, is placed through both 5-inch pieces and provides the supporting member of the frame. The hoist is connected to the cross member with a double loop of chain which makes it possible to slide the hoist in either direction. The frame is light enough so that 4 men can lift and move it.

It is also used in overhauling the pump as well as the engines. The frame is easily dismantled for moving.

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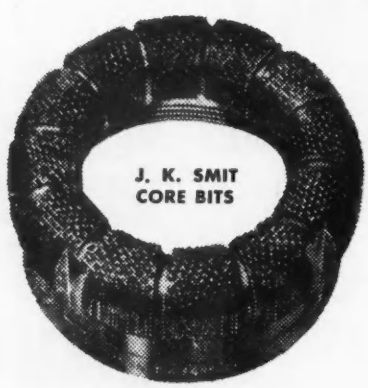

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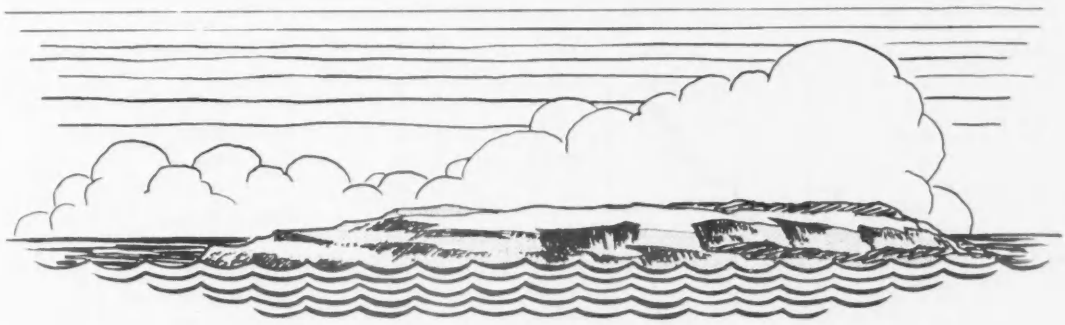

By C. H. KEPLINGER and J. M. WANENMACHER

Consulting Petroleum Engineers, Tulsa

As a result of Scurry County reef discoveries and the recent discovery of substantial oil reserves in limestone reefs in Western Canada, the oil industry is extremely reef conscious. The reef fields of Scurry, Kent and Borden counties occur in an arc. The recent Canyon reef discoveries in Terry County (Figure 1) are believed to be a continuation of the reef. The possibility of extending the reef fields northward at both ends of this horseshoe is now receiving considerable attention.

History and Development

The first reef field discovered in Scurry County was the Schattel field. The discovery well was Sun Oil Company and Humble Oil & Refining Company's Schattel 1, completed July 10, 1948, with an initial production of 480 barrels daily flowing through ¼-inch choke. This discovery proved to be of minor importance as subsequent tests in the immediate vicinity failed to encounter commercial amounts of oil. However, it attracted considerable interest in the area.

Next was Kelly field, discovered by Magnolia Petroleum Company's Winston 1, completed November 5, 1948, with an initial pumping production of 67 barrels of oil with 28 barrels of salt water per day. This well later proved to be at the edge of the field.

On November 21, 1948, Standard Oil Company of Texas completed its Brown 1 well with an initial daily production of 532 barrels flowing through ¼-inch choke. The resulting field, known as North Snyder, has become the largest and most important part of the reef fields.

The Diamond M field was discovered by Lion Oil Company's M. Laughlin 2, completed January 6, 1949 with an initial daily production of 649 barrels flowing through ¼-inch choke.

The Sharon Ridge Canyon field was discovered March 4, 1949, when Humble completed Bishop 1 with an initial flowing production of 349 barrels daily through ⅜-inch choke.

The next important development was the discovery of production in the Canyon lime in the extreme southern part of Kent County. The discovery well is Chapman Cogdell 1 approximately 7 miles north and 4 miles east of the North Snyder. It was completed December 17, 1949 and on potential test flowed at the rate of 596 barrels of oil per day. This area has subsequently been designated the Cogdell field.

FOR MANY YEARS, geologists have recognized the presence of reefs in strata of various ages, and considerable study has been devoted to existing reefs. Many oil fields related to the limestone reefs of North Texas which were discovered prior to 1948 were highly profitable, but none was sufficiently large to threaten the economy of the oil industry. The Scurry County fields have been discovered one after another in short order and development has been rapid.

The next extension was in southeastern Borden County on December 21, 1949, when Amerada Von Roeder 1, approximately 4 miles west of the Sharon Ridge Canyon field, was completed in the Canyon limestone. Initial potential was 185 barrels of oil with 32 barrels of water per day.

Another extension in this direction occurred February 16, 1950, when Livermore Reinecke 1, 5 miles south and 3 miles west of the Amerada well, was completed with an initial production of 1530 barrels per day flowing through ¾-inch choke.

In April, 1950, H. L. Hunt completed Young 1 in the Canyon limestone and extended the play 15 miles north of the Cogdell area. Initial production was 33 barrels per hour flowing through ¾-inch choke.

The allowables were large and the area has been intensely developed in a short time. Development is not complete, but files of the Texas Railroad Commission reveal that during May, 1950, the

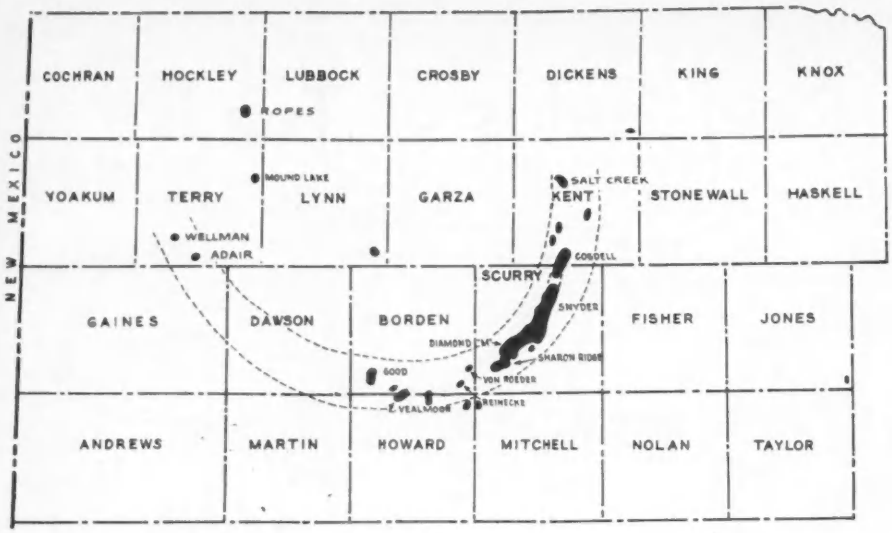

FIGURE 1. Map showing recent reef discoveries in West Texas.

following number of wells were producing from the reef fields:

FIELD	NUMBER OF WELLS		
	Flowing	Pumping	Total
Cogdell	35	..	35
Diamond M	157	1	158
Kelly-Snyder	634	8	642
Reinecke	8	..	8
Sharon Ridge	59	..	59
Von Roeder	2	1	3
Total	895	10	905

Well Spacing and Proration

Development has been on 40-acre spacing and most wells have been drilled at the center of quarter quarter sections. Allowables are based one-half on acreage with 40-acre units as maximum and the remaining one-half on the basis of wells. The allowable was 220 barrels per well per producing day until March 1, 1950, when it was decreased to 110 barrels per producing day. The Railroad Commission allowed 18 producing days in May, 19 in June, 21 in July, and 25 in August.

The allowable and performance of the various fields during May 1950 follow:

FIELD	No. of Wells	Total Allowable	Production (Barrels Monthly)
Cogdell	35	75,680	73,769
Diamond M	158	428,507	422,015
Kelly-Snyder	642	1,712,867	1,700,892
Reinecke	8	159,356	155,929
Von Roeder	2	10,080	5,609
Total	845	2,386,490	2,358,214

Geology

A thin interval of Triassic beds occurs at the surface. Permian strata consisting of limestones, dolomites, and anhydrites with minor shales and sandstones extend to about 5500 feet. Below the Permian is a series of Pennsylvania strata which normally consist of shales with minor interbedded sandstones and rare limestone lenses and extend a depth of approximately 7900 feet. The Pennsylvanian beds are underlain by 100 feet of cherty limestone which rests unconformably upon the Ellenburger dolomite.

The reefs occur within the Pennsylvanian series. The Pennsylvanian consists of a lower subdivision called the Strawn, a middle portion called the Canyon and an upper portion called Cisco. Authorities disagree upon the exact boundaries, but, nevertheless, the terms are in common use.

There is no indication of the proximity of the reef in wells drilled on the flanks until the limestone is reached. The reef build-up is first apparent in the Strawn series and the crest of the reef extends well up into the Canyon series (See Figure 2). The upper part of the Strawn series and the lower part of the Canyon series, which normally consist dominantly of shales with interbedded sands, shales and limestone, change abruptly to a thick limestone reef. Some of the companies most successful in this reef play owe their position to recommendation of geologists who recognized the possibility of a large reef because wildcat tests in the vicinity showed a thickening of the limestone toward the area where the reef is now known.

Structure Not Important

Structure appears to have been of no importance in localizing the reefs. It is true that oil has accumulated in the higher part of

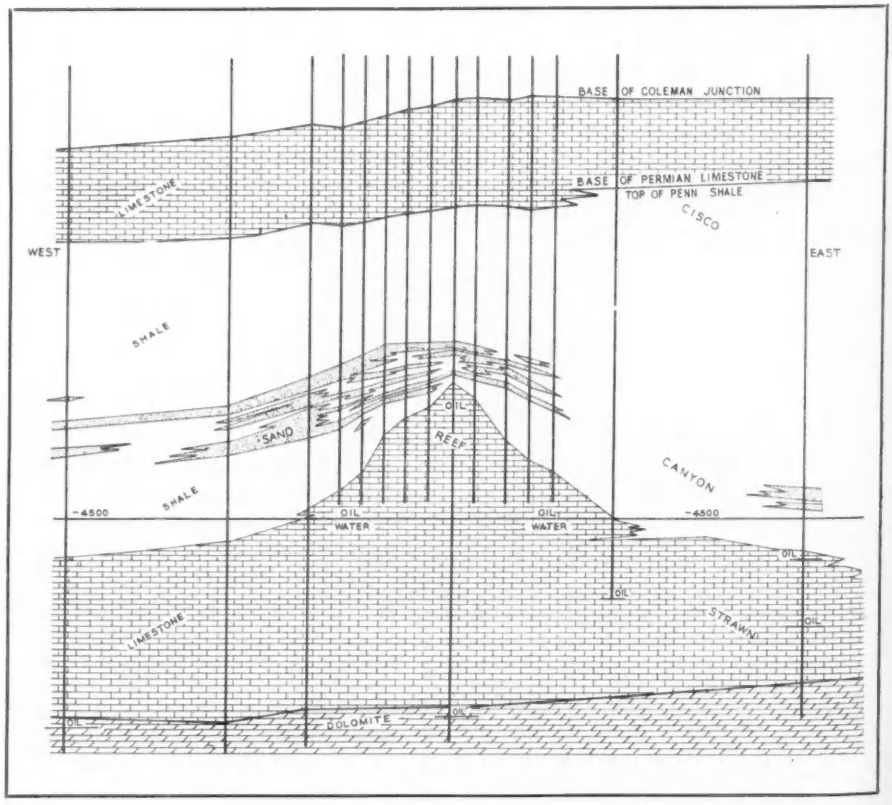

FIGURE 2. Cross section—North Snyder field.

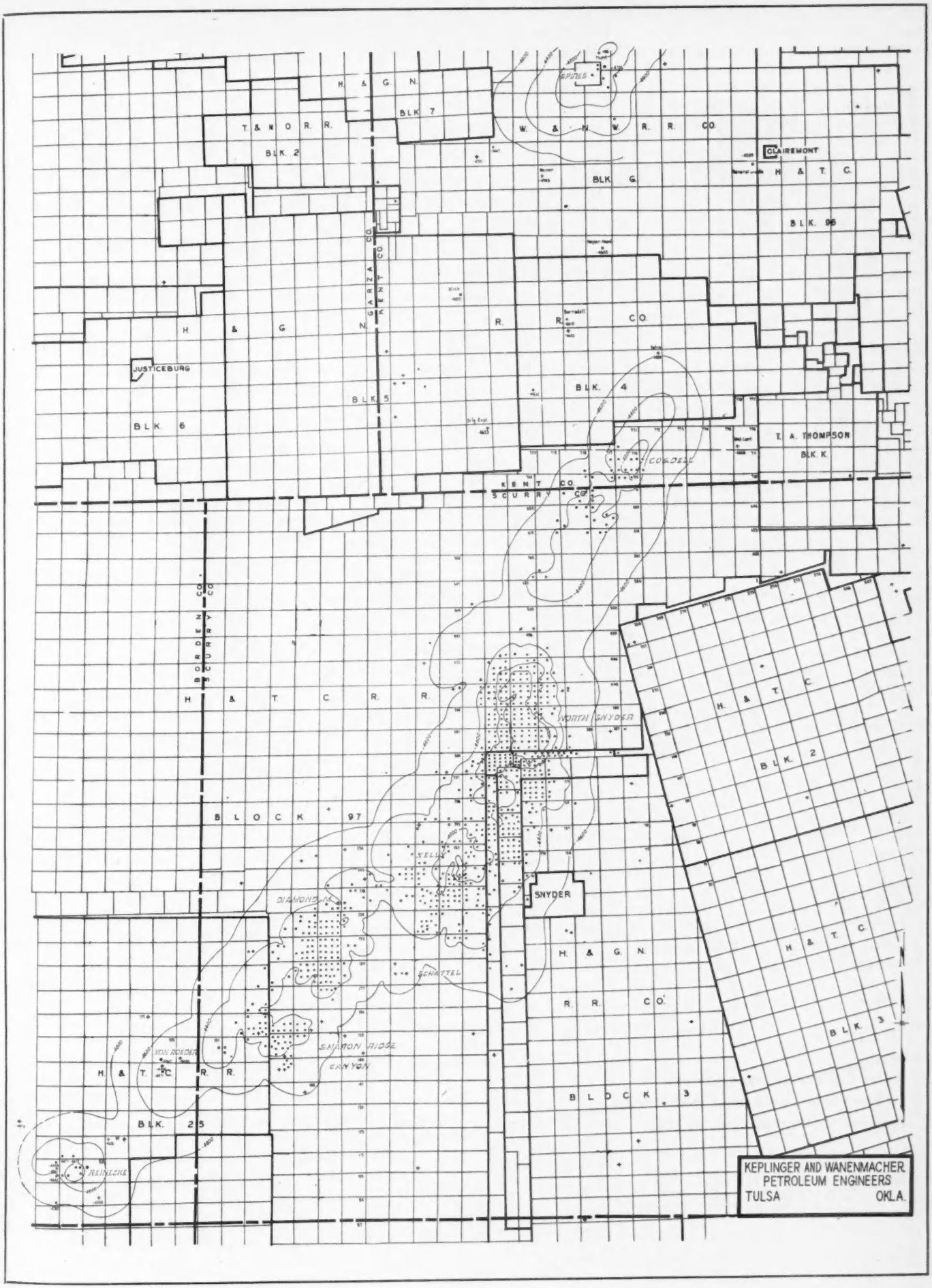
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FIGURE 3

the reservoir due to its tendency to float on water as it does in reservoirs affected by anticlinal folds. However, the differences in elevation of the top of the reef are due to the build-up of a thick limestone deposit by organisms and are not the result of folding.

The strata above reefs not uncommonly show small amounts of dip away from the reefs, but this is due partly to differential compaction and possibly also to initial dips as a result of deposition on sloping surfaces of the reef. Thus, the dips of the shallow strata may be indicative of underlying reefs but it is technically incorrect to designate these results as structure since this term should be confined to the effects of folding.

The top of the reef is an irregular surface (Figure 3). The total relief in the immediate vicinity of the field is large, being in the magnitude of 1000 feet. Locally, relief is very sharp, and there are instances where wells have encountered the top of the reef more than 200 feet higher than offset wells only ¼-mile distant.

The reef is reported to be most porous at its central part with a slight general decrease in porosity near the edges of the fields. Furthermore, core analyses indicate that the average porosity is somewhat higher in the North Snyder field where reef build-up has been greatest.

Oil Accumulation

Oil has accumulated in the upper part of the reef and the lower part contains water. The oil-water contact is at an approximate depth of 4500 feet subsea in the North Snyder, Diamond M and Schattel fields, at approximately 4450 feet subsea in the Kelly field and at approximately 4425 feet in the Sharon Ridge field. These oil-water contacts are not sharp and well defined. Some wells have encountered water at elevations higher than in nearby wells. Other wells have drilled through water bearing zones and found oil below them. These conditions are explained by the irregular development of porous zones within the reef which has resulted in local trapping of water above the general water level in some instances, and in other instances, local accumulation of oil below the water level.

In a few instances, wells which encountered the top of the reef at low elevations encountered substantial amounts of oil in limestone beds at depths of 100 feet or more below the common water level. These deep reservoirs are designated as Strawn and appear to be confined to the eastern side of the field. These older limestone reservoirs are parts of the same reef.

The most noteworthy feature of the Canyon reef fields of Scurry County is the extremely thick interval of oil-bearing limestone above the water level. Locally, in the North Snyder field, a few wells have encountered the top of the reef more than 700 feet above the water level. The thickness of limestone reef above water level varies considerably but the average is probably in the magnitude of 200 feet.

Casing and Completion Practices:

While there is variation in casing programs throughout the area, the general pattern followed provides for a string of surface pipe, usually 9⅝-inch, set through the anhydrite or at the top of the San Andres between 1600-1800 feet. The amount of cement used ranges from 900 to 1000 sacks. Size of the oil string varies among operators between 5½-inch and 7-inch, the larger size being most commonly used. Selection of the casing seat for the oil string follows 3 general trends. Perhaps most commonly, casing is set on top of the reef pay after drilling or coring the section in a reduced hole. Some operators prefer to set casing through the productive section and complete the well through perforations. Still others follow a practice of drilling a full hole to the total depth and swinging the casing at some selected point in the productive section to provide for control of gas-oil ratio or, in some cases, water encroachment. Wells are commonly completed with 2-inch tubing and less commonly, with 2½-inch.

A few operators use a 3-string casing program consisting of about 450 feet of 10¾-inch or 13⅜-inch surface pipe, 1600 to 1800 feet of 8⅝-inch or 9⅝-inch casing as an intermediate string, and 7-inch casing for the oil string.

Since most wells in the area have a strong tendency for natural flow, the use of acid or other methods of stimulating production is not necessary. A few wells, however, have been subjected to acid treatment. The amounts used have varied from 250 gallons in a single stage to 7000 gallons in multiple stages.

Engineering Data and Reserves:

The engineers of the Railroad Commission and operators measured the static bottom-hole pressures in the various fields in March, 1950. These measurements indicated considerable decline from the original bottom-hole pressures. The decline in pressures was quite large considering the relatively small recovery at that time, and

TABLE 1

Scurry County Canyon Reef Fields
Summary of Core Analysis Data
Prepared for Hearing, April 14, 1950

FIELD	No. Wells Analyzed	No. Core Samples	Range of Porosity by Wells Percent	Average Porosity All Samples, Percent
N. Snyder	14	3,434	3.70–14.40	8.36
Diamond M	10	702	2.23–11.18	5.13
Kelly	18	1,467	3.50–14.38	7.64
All Wells	42	5,603	2.23–14.40	7.77

TABLE 2

Summary of Productivity Tests—North Snyder Field

	SOT Brown 2 No. 1	SOT Brown 2 No. 1	SOT Brown 2 No. 5	SOT Brown 4 No. 2	SOT Brown 6 No. 1	SOT Davis No. 3	SOT Terry No. 6
Date of Test	11-20 to 23-48	12-14-48	2-19-30	2-17-50	2-12-50	2-24-50	2-28-50
Productivity Information:							
Choke Size	1st Flow Rate	5/64"	13/64"	14/64"	20/64"	18/64"	11/64"
Rate BOPD	532	40	394.66	407.52	154	360	261.17
P. I.	4.33	13.3	10.39	1.657	0.148	0.824	3.002
Choke Size	2nd Flow Rate	....	9/64"	11/64"	18/64"	14/64"	8/64"
Rate BOPD	290	....	176.5	297.6	139.5	211.2	129.12
P.I.	6.59	....	88.25	1.681	0.134	0.852	1.986
Choke Size	3rd Flow Rate	....	....	5/64"	16/64"	19/64"	....
Rate BOPD	115	....	....	149.28	108.0	121.92	....
P.I.	6.76	....	....	2.195	0.115	0.663	....

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this was viewed with alarm by many who took it as an indication that the reserves were much smaller than they had been led to believe.

Shortly after these measurements were made, the Railroad Commission held a hearing to determine the maximum efficient rate of production of the various reef fields in Scurry County. Considerable engineering data concerning the fields were presented by the operators at this meeting. Some of the more important data follow.

Pay Thickness:

Cores and microlog determinations indicate that the percentage of net pay varies considerably between wells, but averages between 50 and 70 per cent of the total reef pay.

Porosity and Permeability:

The porosity determinations of 5603 core samples from 42 wells range from 2.23 to 14.4 percent. The average porosity of these core samples is 7.77 percent. The results are summarized in Table 1.

Permeability measurements range from 0 to 100 millidarcys with the average between 10 and 15 millidarcys. Another indication of the low permeability of the formation is obtained from the productivity indices which are quite small. A summary of some productivity tests for North Snyder is shown in Table 2.

Reservoir Fluid Analysis:

Analyses of bottom-hole samples of the oil from 10 wells were presented at the hearing. These well samples are from 1 well in the Sharon Ridge field, 2 wells in the Diamond M field, 3 wells in the Kelly field, and 4 wells in the North Snyder field. The oil is undersaturated and has an average saturation pressure of about 1750 pounds. The produced gas-oil ratio is approximately 850 cubic feet per barrel. The determinations in the various fields are shown in Table 3.

Bottom-Hole Pressures:

The bottom-hole pressure in the discovery well in the North Snyder field at 4300 feet subsea was originally 3112 pounds per square inch, and this is representative of the virgin reservoir pressure of the entire field. The average pressure of wells measured by the Railroad Commission in March, 1950, in the various fields was:

North Snyder	2790 psig
Kelly	2980 psig
Diamond M	2550 psig
Sharon Ridge	2900 psig

Oil Reserves:

A consideration of the problem of estimating oil reserves from the Canyon reef horizon involves determination of the probable reservoir performance. Basically, oil recoveries will be dependent upon whether the reservoir energy to produce the oil will come from solution gas or from encroaching edge or bottom-water. No free gas cap was orginally present in the field.

The average barrel of crude oil measured under reservoir conditions will shrink at the surface 37.5 percent, and the stock tank oil will be only .625 barrels. This is equivalent to a formation volume factor of 1.6. The minimum and maximum recoveries which may be expected have been calculated as follows:

Estimated Scurry Canyon Reef Oil Recovery Per Acre-Foot Dissolved Gas Energy

	Bbls/Acre-Foot
Volume of pore space (7.77 percent porosity)	603
Connate Water (20 percent)	121
Volume of oil and gas in reservoir	482
Stock Tank Oil in reservoir (37 percent gas volume shrinkage)	301
Oil left in reservoir after depletion by natural methods (35 percent pore space)	211
Estimated Recovery by Dissolved Gas Energy	90

Estimated Scurry Canyon Reef Oil Recovery Per Acre-Foot Water Drive Conditions

	Bbls/Acre-Foot
Volume of pore space (7.77 percent porosity)	603
Connate Water (20 percent)	121
Volume of oil and gas in reservoir	482
Stock Tank Oil in reservoir (37.5 percent gas volume shrinkage)	301
Oil left in reservoir after water drive (20 percent pore space)	120
Estimated Recovery by Water Drive	181

It is evident from the above approximations that water drive performance would double the expected recovery from dissolved gas energy. The field will have to be produced and observed before definite conclusions are reached as to

TABLE 3

Scurry County Pennsylvanian Reef Fields—Summary of Reservoir Oil Analysis—Prepared for Hearing April 14, 1950

Number	1	2	3	4	5	6	7	8	9	10
Field	Sharon Ridge	Diamond "M"	Diamond "M"	Kelly	Kelly	Kelly	N. Snyder	N. Snyder	N. Snyder	N. Snyder
Company	Humble	Sun	Lion	Pan Amer.	Barnsdall	Sun	Moncrief	Sun	Sunray	Standard
Well	No. 1 Huddleston	No. 1 Boyles	No. 2 McLaughlin	No. 1 Woolever	No. 1 E. Williamson	No. 1 M. Lemons	No. 1 Huckabee	No. 1 Brice	No. 1 Brown	No 1 Brown
Well Location	Sec. 163, Blk. 97, HXTC Sur.	Sec. 201, Blk. 97, HXTC Sur.	Sec. 183, Blk. 97, HXTC Sur.	Sec. 249, Blk. 97, HXTC Sur.	Sec. 246, Blk. 97, HXTC Sur.	Sec. 205, Blk. 97, HXTC Sur.	Sec. 160, Blk. 3, HXGN Sur.	Sec. 392, Blk. 97, HXTC Sur.	Sec. 20, Blk. 1, J. P. Smith Sur.	Sec. 440, Blk. 97, HXTC Sur.
I Reservoir Temperature, °F	128	122	130	132	128	122	131	122	123	123
a. Saturation Pressure, psig	1890	1918	1946	1838	1860	1720	1743	1737	1725	1725
b. Viscosity of Saturated Oil at Reservoir Temperature, Cp.	* 0.33	.....	0.34	0.33	0.50	.....	.....	.....	0.66	0.675
c. Compressibility Relative Volume at:										
3500 psig	.9788	.....	.9750	975	.9767	.....	.....	.....	.....	.....
3000 psig	.9847	.....	.....	.982	.9823	.....	.9845	.....	.9817	.9822
2500 psig	.9910	.....	.....	.990	.9900	.....	.9905	.....	.9881	.9883
2000 psig	.9984	.....	.9989	.996	.9975	.....	.9965	.....	.9957	.9955
II Flash Liberation Temperature, °F	76	.....	74	76	70	.....	75	.....	70	70
Gas-Oil Ratio, Atmos. Flash	1176	.....	1168	*944	1077	.....	989	.....	1037	967
Formation Volume, Ve/Vr	1.68	.....	1.691	*1.573	1.6558	.....	1.6279	.....	1.6240	1.6035
A.P.I. Gravity	41.8	.....	41.6	*43.3	41.7	.....	40.2	.....	41.0	42.1
III Composition:										
Mol. Weight of Heptanes plus	.....	.....	195	203	192.2	.....	191.5	.....	195.2	190.8

* Flash Liberation to 20 psig.

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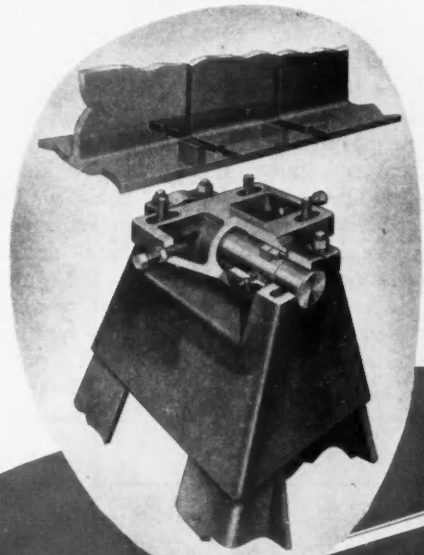
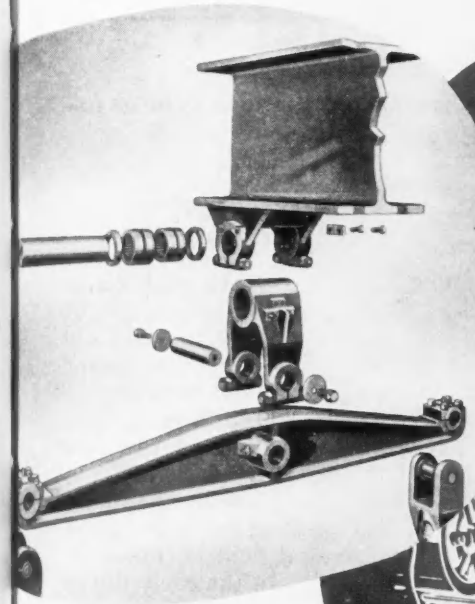
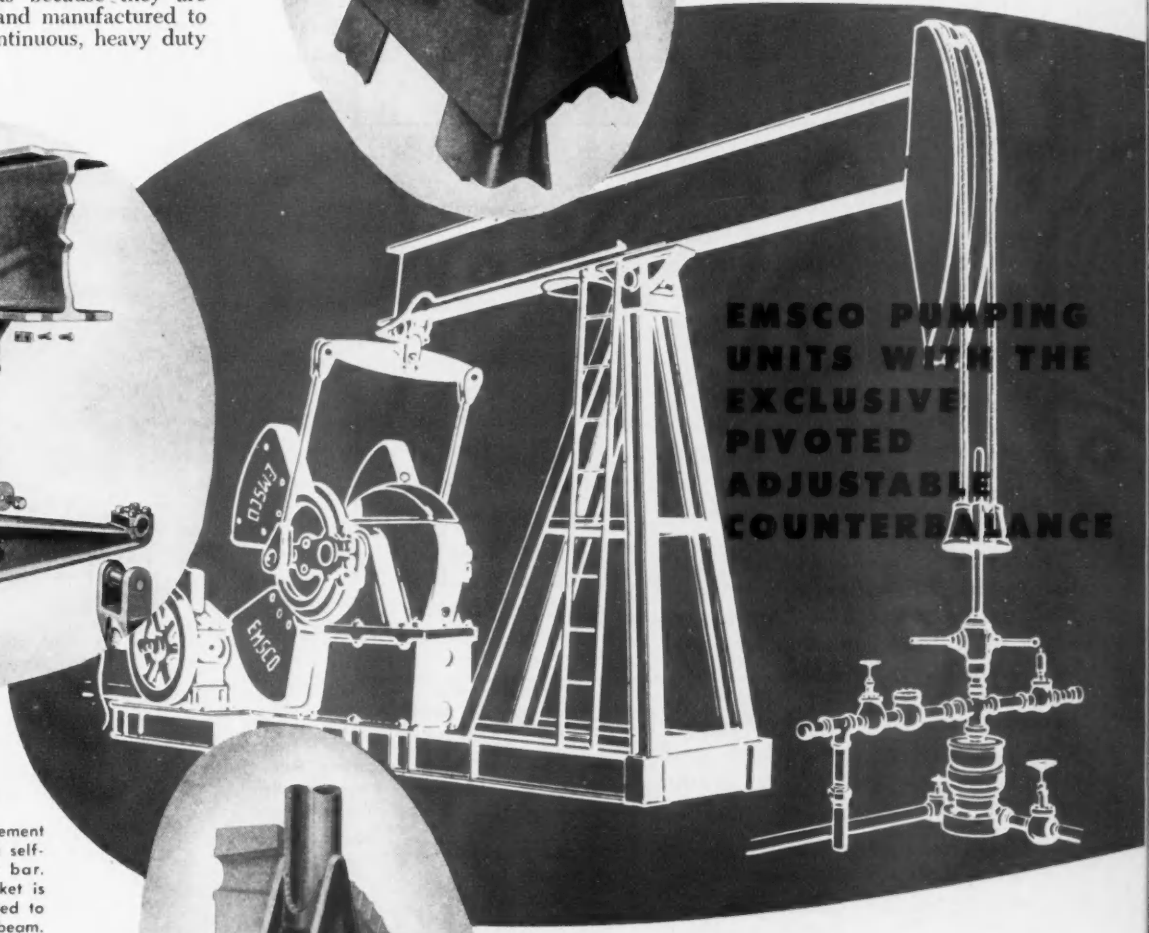


CENTER IRON

Heavy duty, needle roller bearings mounted in the center iron run on a hardened and precision ground shaft clamped to the top of the Sampson post. Bearings are protected by pressure relieved grease seals. Slotted holes and jack screws in center iron allow positioning of the carrier bar directly over the well head.





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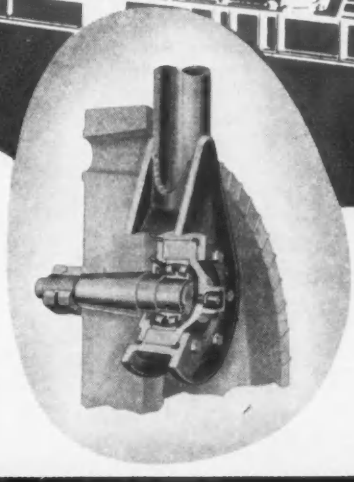
This assembly allows free movement in two planes, giving absolute self-alignment of the equalizer bar. Equalizer hanger bearing bracket is a machined steel casting welded to the bottom of the walking beam. Bearing pin is made of hardened and ground alloy steel. Seal protected needle roller bearings are lubricated from top of the safety ladder.



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About the Authors

C. H. KEPLINGER entered consulting practice for appraisal of oil and gas properties on December 1, 1944, after 15 years' experience in Mid-Continent oil industry. He received his B.S. in physics from the University of Tulsa in 1931, spent a summer term studying geophysics at Goettingen University, Germany, and in 1933 took his master's degree in physics at George Washington University. Keplinger's first oil country job was in 1929 as a roustabout at Marshall, Okla., for Shell Oil Company. He rejoined Shell in 1933, and during the succeeding years to 1944, was engaged in production and reservoir engineering work for Shell in Kansas and Oklahoma. He is a member of ASME, AIME, AAPG and API.

J. M. WANENMACHER'S career dates back to 1926, and has taken him to oil centers in South America and Europe, as well as in the U. S. Before he received his Ph.D. in geology from Wisconsin University in 1932, he worked as a field geologist in Colombia and Venezuela for Gulf Oil Company, and as assistant to chief geologist of foreign operations with headquarters in New York. Wanenmacher joined Shell Oil Company in 1932, and worked in the Mid-Continent area as subsurface and exploitation engineer until 1939, when he was sent to The Hague on special assignment with Shell's parent organization. He returned to the Mid-Continent and continued with Shell until 1945, when he became a consultant.

nature of the reservoir energy. At this time, based on limited reservoir performance, core analyses, well productivity tests, and material balance calculations, it is probably advisable to use a recovery factor of approximately 100 barrels per acre-foot of reef above water level as an average for the pool with the reservation that this might be doubled by a natural water drive or a water injection program.

As an additional confirmation of the probable recovery from the pool, material balance calculations were made based on the past performance of the reservoir. A summary of the pressure drops by pools to April 1, 1950, together with cumulative production and cumulative production per pound pressure drop is as follows:

	Pressure Drop Lbs./In.^{2} to April 1, 1950	Estimated Cumulative Production To April 1, 1950 Barrels	Barrels Per Lbs./In.^{2} Drop
North Snyder	322	4,827,130	14,980
Kelly	132	1,313,828	9,940
Diamond M	562	1,425,077	2,540
Sharon Ridge	212	567,941	2,675
	....	.....	30,135

By assuming no water drive, production to date has been due entirely to expansion of oil. To estimate oil recoveries, we have used a material balance equation which applies to an undersaturated reservoir such as the Canyon Reef in Scurry County. The equation is as follows:

$$S = \frac{Q}{c \times C}$$

Where S = Volume of reservoir originally occupied by oil and dissolved gas.

c = Factor for shrinkage from reservoir fluid to stock tank oil.

C = Expression for the compressibility factor.

Q = Barrels of accumulated tank oil per psi drop in pressure.

Based on a production of 30,135 barrels per psi drop in pressure, a compressibility factor of 12×10^{-6} volume per volume per psi, and a shrinkage factor of .625, we calculate the volume of reservoir oil at reservoir conditions to be as follows:

$$S = \frac{30135}{.625 \times 12 \times 10^{-6}}$$

$$= 4{,}018{,}000{,}000 \text{ barrels}$$

The volume of stock tank oil in place based on a shrinkage factor of .625 would amount to 2,511,250 barrels. Assuming a recovery factor of 30 percent, the oil recovery is expected to be 750 million barrels.

Attention is called to the fact that data used to estimate the stock tank oil in place by the material balance method are based upon only one general field bottom-hole pressure survey. In the early life of a reservoir, small errors in the measurement of equilibrium bottom-hole pressures will give unreliable results. Additional pressure surveys are needed before consistent results can be attained in estimating the amount of oil in place or the reserves.

Table 4 is a comparison of factors between the reef fields of Scurry County and the Redwater field of Canada which is also a reef field. The average porosity of the reservoirs is nearly the same in both pools. However, the permeabilities are very different. The Scurry reef has much lower permeability and well productivity indices.

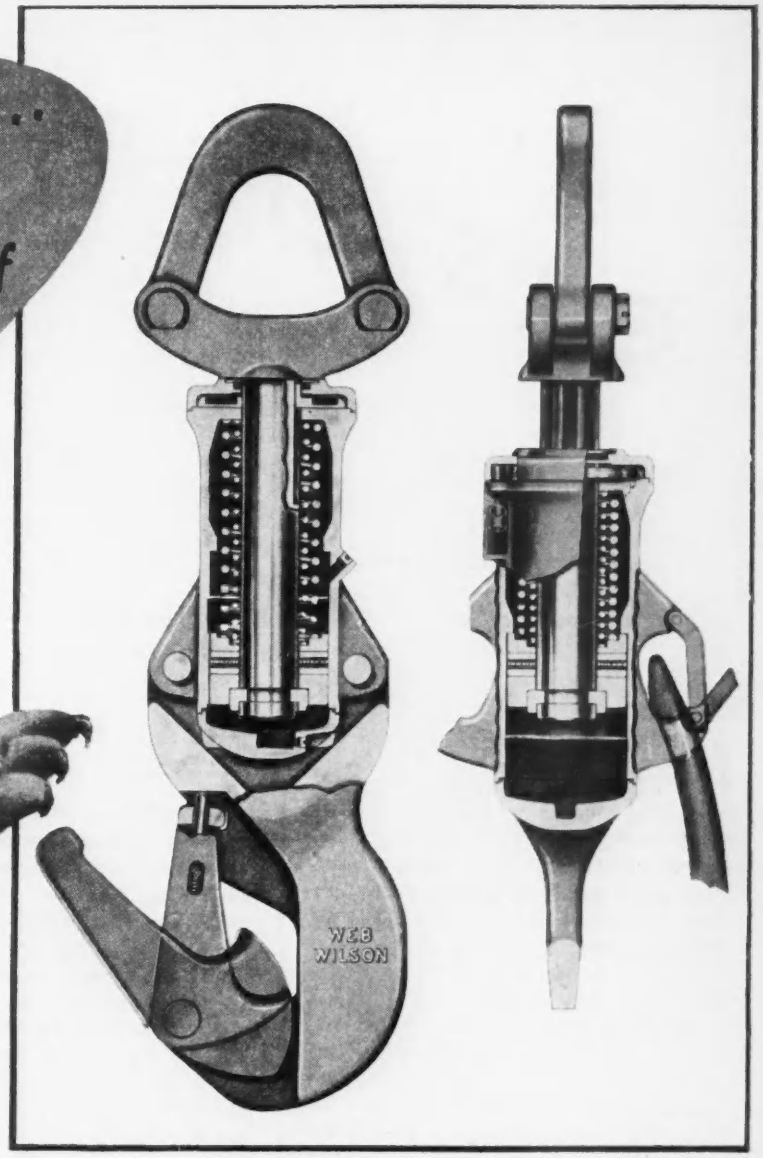
The performance of the newly discovered reef fields of Scurry County and adjoining areas will undoubtedly be observed closely because of their importance to the oil industry. It will be interesting to ascertain how these fields conform to predictions made now.

TABLE 4
RESERVOIR DATA
Comparison of Scurry Canyon Reef with Redwater (Canada) Devonian Reef

	Scurry	Redwater*
General:		
Thickness of porosity above water (Maximum) Feet	650	150
Elevation of water table, (Feet Subsea)	4500	1238
Areal extent, acres	50,000	40,000
Reservoir Fluid Properties:		
Original Reservoir Pressure, psig	3112	1050
Reservoir Temperature, Degrees, F	128	94
Solution Gas-Oil Ratio	900	180
Shrinkage factor	.625	.88
Gravity of oil	42	35
Reservoir Rock Properties:		
Porosity, percent	7.77	8
Connate water, percent	20	12
Permeability, md	0—100	0—infinite
Productivity Index, bbls./day/psig	Low (2-5)	High (120)
Volumetric Estimate:		
Volume of oil in place per acre-foot, Bbls	301	490
Estimated Recovery per acre-foot	100	200
Type of Reservoir Drive	Dissolved Gas	Water
Estimated Ultimate Recovery, Bbls	750,000,000†	500,000,000

* Taken from a paper by Mr. James E. Baugh, Engineer for Petroleum and Natural Gas Conservation Board of Alberta—page 21—Vol. 3 No. 4, May, 1950, Canadian Oil and Gas Industries Magazine.

† From material balance calculation.



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GAS LIFTING Deep Wells *in the Permian Basin*

By WILLIAM P. MASSEY
Camco Gas Lift Company, Odessa, Texas

A LIFTING PROBLEM currently faced by many companies operating deep and older wells producing from the Ellenburger formation. Fluid levels are dropping and water-oil ratios are increasing. The author presents basic factors pertinent to the problem of gas-lifting these very deep wells. Some Ellenburger wells are as deep as 13,000 feet although fluid levels at present are considerably above that depth. Various examples are given along with basic data used in gas-lift valve setting calculations.

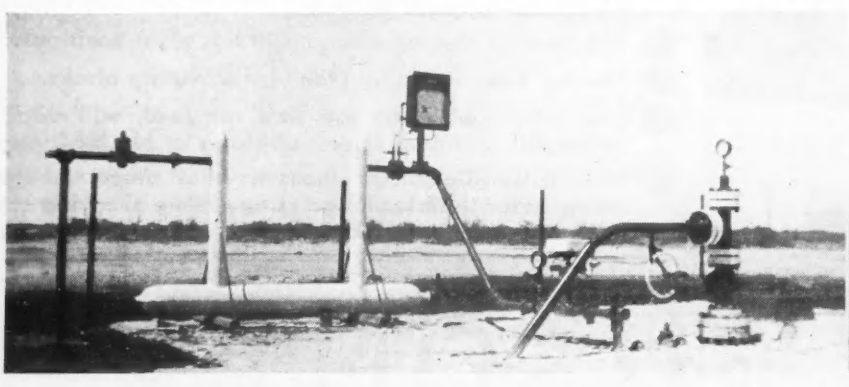
DECLINING bottom-hole pressures and increasing water encroachment are two factors causing fluid levels to drop in deep wells in the Permian Basin. This condition will in the near future pose a serious lifting problem for extremely deep wells. Where an ample supply of high-pressure gas is available, either from a gas well or compressor equipment, this problem has been solved by the proper application of pressure controlled gas-lift valves.

To lift large volumes of fluid efficiently from great depths, it is first necessary to consider several facts on the surface. Separator back-pressure should be kept as low as conveniently possible. Length of the flow line usually can not be shortened to decrease flow friction, but the operator can use a flow line the diameter of which is equal to, if not greater than, the tubing string. Reduce the number of 90-degree ells and swings as much as possible. The flow line should connect into the tubing head with a wide arc, and if well characteristics are such that a surface choke is necessary, it is recommended that the maximum choke opening be as large as the tubing.

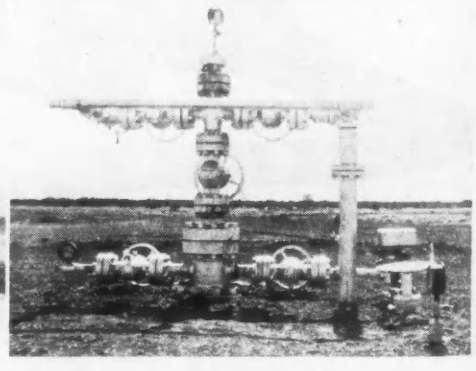
The tubing string should have no restriction that might impede fluid movement. All pressure controlled valve mandrels are full opening, with a few exceptions that usually involve small annulus areas. Packers should be run with most installations to increase flow efficiency and provide a closed installation.

Valve Characteristics

The pressure-controlled valve may be described as an unbalanced back-pressure valve. It connects into the side of a tubing mandrel which in turn screws into the tubing. (See Figure 1). This valve can be set to open and close at any desired pressure. It can be opened to admit gas pressure from the casing to the tubing at any depth, and is controlled from the surface. Some improvements for different well conditions have resulted in 2 distinct variations from the original pressure-controlled valve, but the basic mechanism is unchanged. One



Gas lift installations on deep Ellenburger well in the Pecos Valley. A scrubber unit and orifice meter were included on gas injection line, along with time cycle controller near well head.



This gas lift well produces 1400 barrels fluid daily from the Ellenburger in the Benedum field. Total depth is 11,620 feet.

type is the constant-flow, pressure-controlled valve, with which it is possible to effect constant flowing conditions in deep, high-volume wells and at the same time operate from the lowest point with the maximum available operating pressure. This type valve is designed to isolate the actual casing pressure from the enlarged disk area which is exposed to the tubing pressure. Thus the tubing pressure constitutes a controlled opening force in conjunction with injection gas volume. A flow chart on a high-volume well with this installation is shown in Figure 2.

The other valve type, the balanced back-pressure valve, is specifically designed for use in extremely deep wells of normal to low-volume characteristics. It is desirable for chamber installations where maximum tubing back-pressures are encountered and a large net port area is absolutely necessary. This valve is controlled from the surface by intermittent gas injections pre-determined by a time cycle controller. The head of this valve is designed so as to permit the tubing pressure partially to balance itself out as an opening force of the valve. The disk or port area ranges from ½-inch to ⅝-inch diameter, and for all practical purposes is completely controlled by the casing pressure. This allows the greatest volume of gas to pass through the large valve port in the shortest period of time. This action in the well immediately places a piston head of high-pressure gas underneath the hydrostatic fluid head and pushes it to the surface with little slippage. In gas-lift terms this is called "slug flowing." The small percentage of tubing back-pressure effective force is an advantage since it aids in opening the valve immediately after injection is started at the surface.

Combination Strings

It is common practice to run a combination string of valves. This combination employs constant flow-pressure controlled valves in the upper portion of the string and the partially balanced back-pressure valve below. Such an installation will handle many conditions that may occur in the well over a long period of time and carry it to economic depletion. In early life the fluid level will be comparatively higher, so it is possible to effect a constant flow or intermit from the upper valves. During this initial period the lower valve serves merely as a medium for unloading the fluid in the casing annulus. As the bottom-hole pressure and fluid level decline, it eventually will be necessary to operate from the lower or "slugger" valve.

Complete information on the well to be lifted is of much benefit. This information includes: 1. productivity index and bottom-hole pressure data; 2. bottom-hole temperature; 3. producing formation; 4. total amount of fluid desired in 24 hours; 5. water percentage and its rate of increase; 6. total depth and casing seat; 7. size and weight of casing; 8. size and thread of tubing; 9. available maximum gas pressure and volume; 10. specific gravity of gas.

The productivity index is sometimes unavailable because the well is dead. In most cases, however, this information is available in an offset well of similar characteristics. In some cases it is possible to swab the well and ascertain the amount of production the well can make. This is not advisable in extremely deep wells. In many cases the operator, already familiar with the well from time of completion, can estimate the production capacity of the well. The formula chart (Figure 3) is based on gas-lift flow tests and enables the engineer to determine maximum volumes of fluid that can be lifted efficiently from maximum depths. This may be determined from the surface casing gauge reading or by running a bottom-hole pressure survey. From these data, it can be shown that the installation is producing all fluid that enters the well bore. There are cases of gas-lift installations employing pressure controlled valves in which the results obtained amount to much more production than the initial potential of the well.

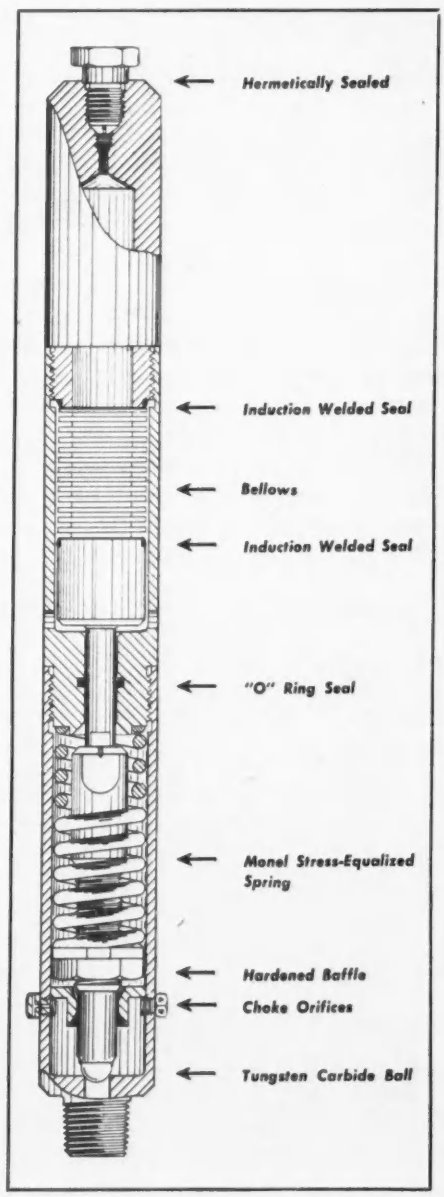


FIGURE 1. Pressure Controlled Valve.

Installation Calculations

In designing a gas-lift installation, first considered is the maximum available gas pressure. If the static fluid level is near the surface, the maximum pressure is divided by the static gradient which gives the depth in feet from the surface to space the top valve. If the static fluid level is below this depth, then the spacing of the top valve is at the static fluid level. It is then necessary to maintain a greater differential pressure in the casing annular space than in the eductor tube. This differential depresses the fluid in the casing past each valve as it descends to the operating valve. As each valve is uncovered, gas is admitted into the tubing and aerates the column of fluid above the valve. This aeration immediately reduces the fluid head from static to flowing gradient.

In calculating the depth of the next valve, it is necessary to assume an average flowing gradient above the upper valve. The total weight of this flowing column subtracted from the operating pressure of the valve gives a differential presure into which is divided the static gradient below the valve. The resultant number of feet is the depth to the next valve. This procedure is repeated until the operating valve is reached.

X = Spacing (distance between valves).

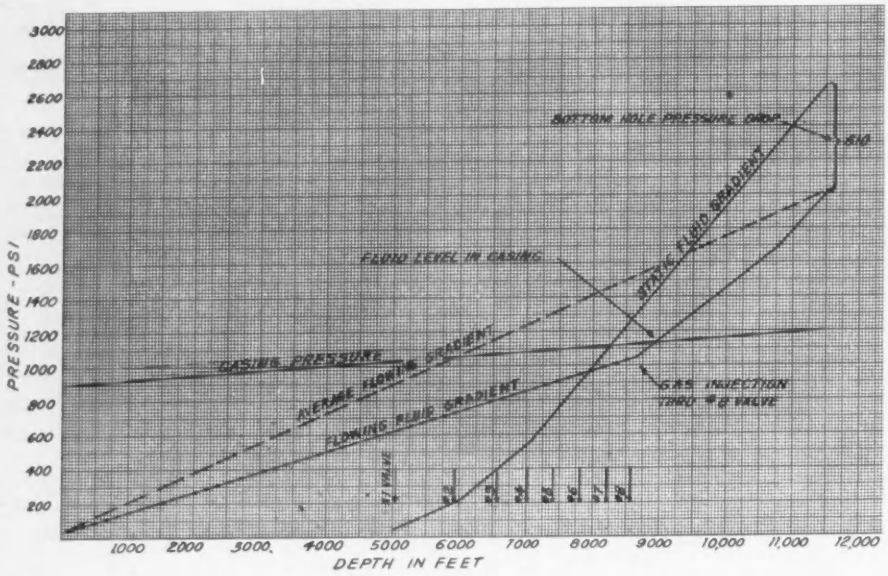


FIGURE 2. Bottom-hole pressure survey on gas lift well. Constant flow installation; 2½-inch tubing; production 1000 barrels daily.

P_o = Operating pressure of valve
G_f = Flowing fluid gradient factor
D_e = Depth of effective flowing gradient factor
G_s = Static fluid gradient factor (use 0.50)

$$X = \frac{P_o - G_f(D_e)}{G_s}$$

In assuming the flowing gradient factor, reference is made to the formula chart (Figure 3). Many tests performed in gas-lift wells during the past several years have resulted in these average gradients and volumes. For example, a well with 2½-inch tubing is expected to deliver 400 barrels of fluid in 24 hours. A flowing gradient factor of 0.08 is estimated. It is recommended that as the static gradient factor below the valve, 0.50 be used to allow a safety factor. In heavy salt water wells a bottom-hole pressure survey is recommended because heavier static gradients may be encountered, a greater factor must be used in design calculations.

By using constant flow pressure controlled valves as the upper or unloading valves, it is possible to set them all at the same operating pressure, generally 25 to 50 pounds per square inch below the maximum available pressure. This maximum pressure should be calculated in sufficient volume to economically deplete the well. Depending on the size of the eductor tube, valve orifice sizes or areas which increase with the depth of the valve can be calculated. The pressure of the bottom or slugger valve is set lower than the upper or constant flow valves. This operating pressure depends on the depth and the maximum hydrostatic head between gas injection cycles. This ensures that the upper valves remain closed during this operation.

Temperature effect on pressure-controlled valves is an important factor. However, the rise in operating pressure due to increased temperature is compensated to a great extent by the weight of the gas column, so that surface operating pressure usually does not vary to any great extent with the valve operating pressure. Due to low geothermal gradients in most of the Permian Basin, in most cases the gas column weight over-compensates the increase in bottom-hole temperature. There are exceptions to this rule, however, and each well has varying characteristics which must be considered. These exceptions still apply to what is generally considered efficient operating surface pressures for wells of extreme depths. For wells from 8000 to 10,000 feet deep, surface pressures of 600 to 800 psi give efficient operation; from 10,000 to 12,000 feet, 900 psi surface pressure results in reasonable gas-fluid ratios.

Typical Installation

A typical gas-lift installation is in a Devonian well in the Shafter Lake region of Andrews County. This well had never flowed and the operator wanted to test it. Total depth was 11,099 feet; bottom-hole pressure, 643 psi; static fluid level, 9518 feet from surface; casing size and weight, 5½-inch, 17-pound; and tubing size 2-inch external upset ends. A nearby Yates gas well supplies a sufficient gas volume at 920 psi. This well is a 4-valve installation. Valve pressures and depths are run in the following order: 875 psi at 9594 feet, 875 psi at 10,142 feet, 875 psi at 10,624 feet, and 800 psi at 10,935 feet.

A hook-wall packer and sour-

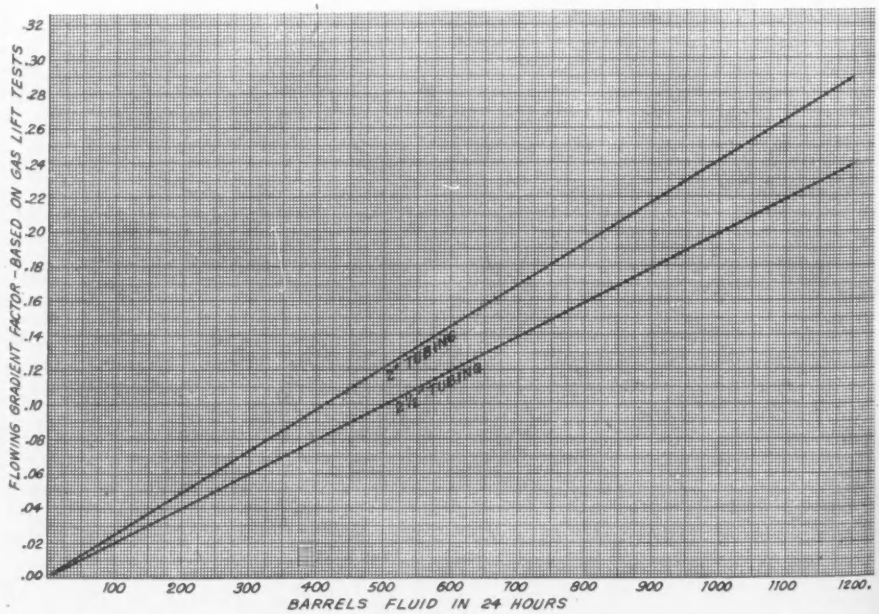


FIGURE 3. Formula chart for gas lift calculations, based on actual flowing gradients and volumes.

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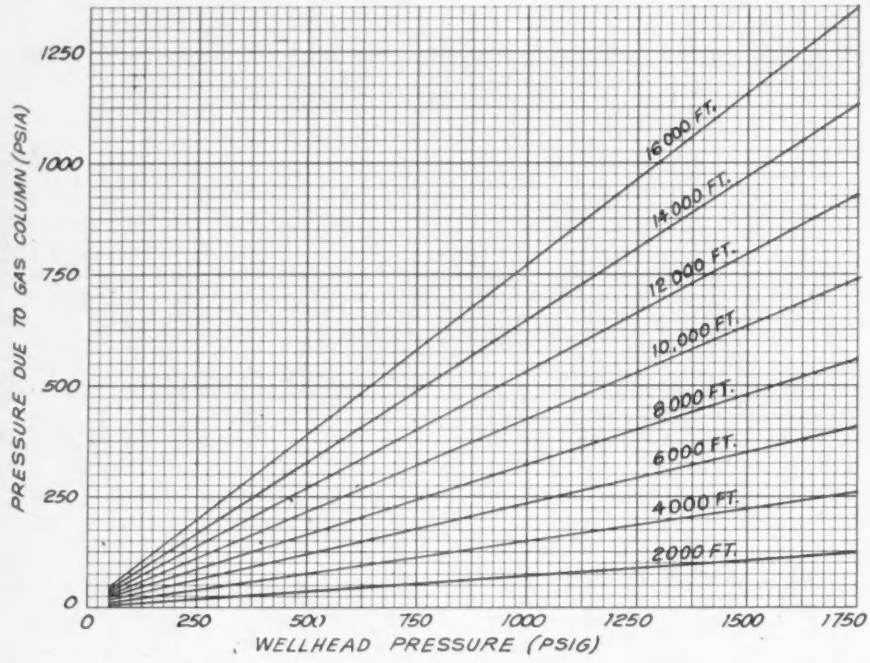


FIGURE 4. Chart for determining the pressure due to a column of gas. This chart is for air gravity of 1 and average temperature of 100° F.

To correct for gas gravity and temperature, multiply the chart result by $G \times \frac{520}{460 + T}$, where

G = Gravity of gas, and
T = Average well temperature, °F.

lake type standing valve were installed at 10,966 feet, making this a closed system. After 1½ years of operation, the latest report shows this well to be producing 106 barrels fluid with input gas-fluid ratio of 1290 cubic feet per barrel fluid. Surface casing operating pressure recedes to 740 psi prior to injection period of 1 minute 40 seconds in each 30 minute interval. This is accomplished with a conventional time-cycle control intermitter with a 24-hour rotation, 7-day wind clock. The intermitter makes this a semi-automatic operation, since the operator has to wind the clock only once a week.

Constant-Flow Example

An example of a constant-flow installation is in an Ellenberger well in the Benedum field. The operator desired to produce 1000 barrels of fluid every 24 hours. Total depth was 11,620 feet; static fluid level, 5010 feet from surface; 7-inch casing; and 2½-inch EUE tubing. Calculations of gas weight, temperature (figures 4 and 5), and assumed flowing gradient were made when it was learned the installation could operate with 900 psi. surface pressure. Previous bottom-hole pressure surveys helped considerably. Constant flow valves were set at pressures of 1100 psi to total depth of 8554 feet from the surface.

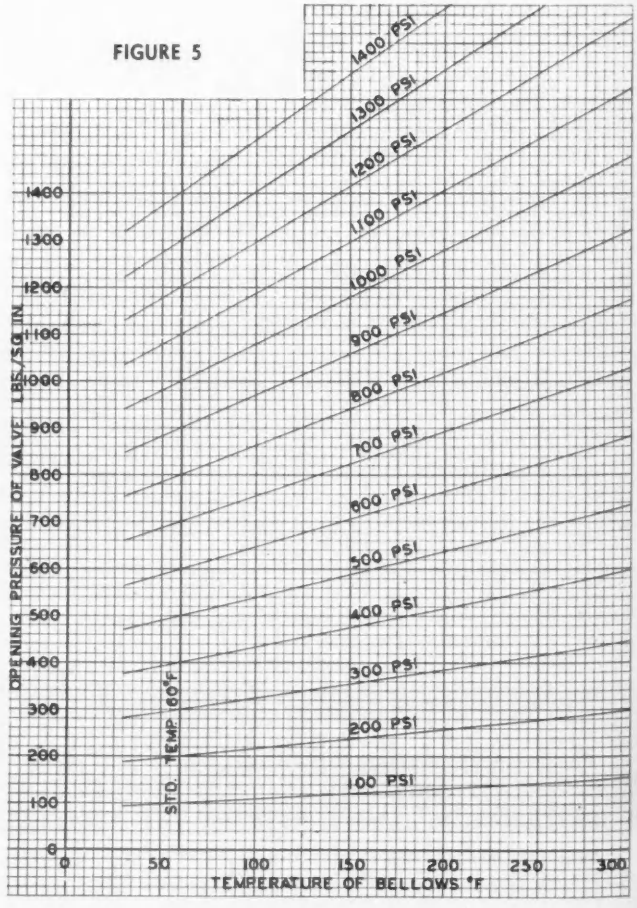
Latest reports show this well to be producing a total of 1416 barrels of fluid per day, with 88.6 percent water. In several wells of this type, bottom-hole pressure surveys show that aeration of the fluid in the eductor tube above the bottom valve permits formation gas to break out of solution at a lower point. Consequently, the well helps put itself in a flowing condition far below the bottom valve due to the decrease in hydrostatic pressure above.

An oil company in Lea County, New Mexico, has several wells producing from the McKee sands formation at approximately 9400 feet. Rapidly declining bottom-hole pressures characterize these wells and all installations have been patterned after the original installation, which is a combination as described above. All valves are intermitting from the bottom valve which is set at 600 psi and approximately 100 feet off bottom. Individual well production figures range from 48 to 215 barrels fluid per day, and input ratios range from 660 to 1215 cubic feet gas per barrel fluid.

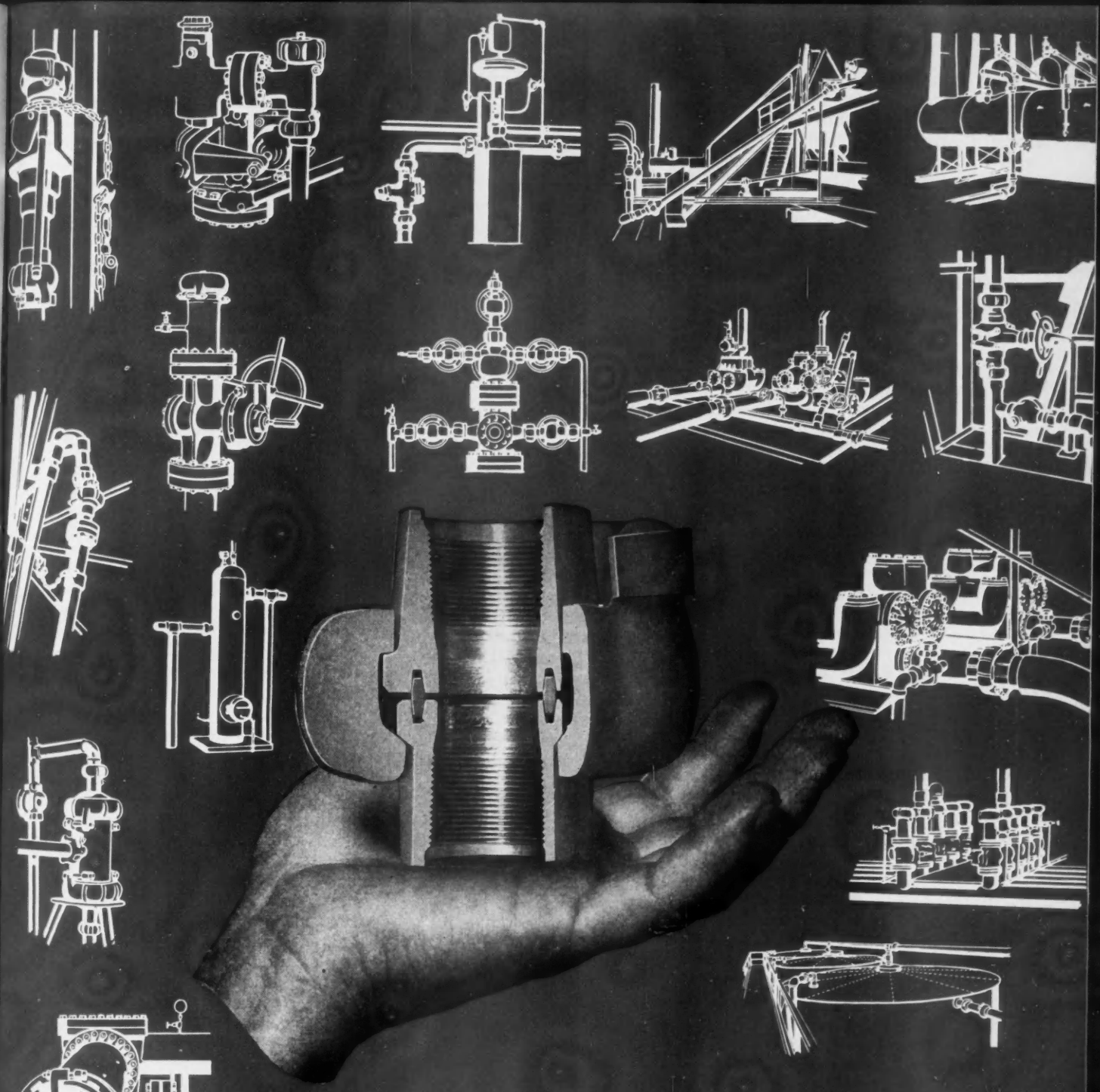
Gas-Lift Pumping Combinations

Several installations employ pressure-controlled valves in conjunction with pumping equipment. These installations are adaptable

FIGURE 5



Opening pressure (psig) for flow valve at various temperatures (°F.) (For bellows only, without spring.) Data based on: Effective area of bellows = .645 square inch. Area of stem = .095 square inch.



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to high gas-oil ratio deep wells which have to be artificially lifted. When the casing is shut in, it is found that pressure build-up is considerable over a short period of time. In most cases this build-up contributes to gas locking the bottom-hole pump, and the effect is a resultant decrease in production.

Pressure-Controlled Valves

By observing the maximum build-up in casing pressure, it is possible to install pressure-controlled valves using practically the same formula employed in a regular gas-lift installation. This combination allows the pent-up casing pressure to enter the tubing, aerate the fluid column and relieve the hydrostatic pressure above the bottom-hole pump, and simultaneously reduce the gas pressure in the casing annulus that aggravates gas locking conditions. These installations have resulted in increased production and a fewer number of strokes per minute necessary for the pump. The pump can also be set to a lower depth due to the decrease in effective polish-rod load. Pressure-controlled valves have smaller ports to allow gas to enter the tubing at the volume necessary to lift the fluid, but not in too great a volume, which might possibly tend to over-heat the polished rod at the surface.

Many deep wells cease to flow when there is considerable pressure in the casing at the surface. In some cases, as much as 1200 psi casing pressure has been recorded with zero tubing pressure. By checking the gas volume at this pressure, it may be possible to install differential flow valves and extend the flowing life of the well. This type installation allows the kinetic energy of the gas in the casing annulus to enter the tubing and lift the well from points higher than the bottom of the tubing string. The volume of gas entering is controlled by the ports in the differential valves, and the valve opening and closing is controlled by the differential pressure between the casing and the tubing. A surface intermitter is usually installed in the flow line. The well is opened and closed on a time-cycle basis, which is another method of slug flowing. This type of operation generally results in lower gas-oil ratios, due to higher point of lift, and much slower decline in bottom-hole pressure. Since the fluid is produced in slugs, the formation of paraffin is greatly decreased.

Corrosion Problems

Corrosion and deposition are production problems in many deep wells in the Permian Basin. Much corrosion is due to hydrogen sulfide content of the fluid and electrolysis. Deposition is due mainly to calcium carbonate and iron sulfide content. Preventive measures have been discovered to combat these problems in gas lifting. All valves are constructed of monel metal, which is resistant to most corrosive conditions; flow lines and gas lines are insulated at the well heads. Where the lift gas has iron sulfide content, a complete scrubber unit is installed. Chemicals can easily be injected into the tubing string, through the valves, to prevent corrosion or formation of calcium carbonate.

Small packaged compressors have solved the problem in many isolated areas where high-pressure gas is lacking. Closed rotative systems have been installed to work in conjunction with pressure-controlled constant-flow valves in the wells. These systems allow the same gas to be used repeatedly, and formation gas, in most cases, keeps down the cost of purchasing external make-up gas except in the initial pressuring operation. In the Permian Basin there are many areas where the operators are pooling their resources, and forming operating committees to supervise production and gasoline plants. Compressor systems have been installed with the gasoline plants for primary purpose of injecting high-pressure gas into the formation to maintain bottom-hole pressures. Simultaneously gas is delivered to the field from a lower compression stage for gas-lifting the wells. After lifting the fluid, the gas goes through the separator and to the gasoline plant, making a complete cycle. Although the gas is not as rich in heat content as formation gas, the fact that it is enriched and stripped repeatedly gives the operators an additional revenue and conserves the gas along with affording an efficient method for lifting the oil.

Dual Completions

During the past 2 years several dual completion gas-lift installations have been made in deep wells in the Permian Basin. These have been very successful due to the constant flow pressure controlled valve. Both formations usually have varying productivity indices, bottom-hole pressures, and flowing characteristics. The constant flow valve automatically selects the operating fluid levels for both pays, since the pressure in the eductor tube is a controlling force in opening and closing the valve. A new dual completion valve mandrel has recently been introduced which allows the casing annular space to be the gas volume chamber. Fluid flow is directed through a macaroni string and the annular area between the macaroni string, for the bottom and top formations respectively. In this manner an even more efficient dual completion gas-lift operation is possible.

Where applicable and when economically feasible, gas-lift installations have proved efficient in lifting fluid from very deep wells. When adequately pressured gas is available, and equipment is present to handle such pressures, there appears to be no special problem in gas-lifting very deep wells, if there is sufficient fluid to be lifted.

About the Author

WILLIAM P. (PAT) MASSEY has been in oil field work since his graduation from high school in Muskogee, Okla. He worked in East Texas for Atlas Supply Company from 1936 until 1940, when he joined the engineering sales department of Olsco Manufacturing Company, Longview, Texas. In September, 1942, he entered the Air Corps, where he studied hydraulics engineering at Massachusetts Institute of Technology. For 3 years following the war, he was associated with Garrett Oil Tools as sales engineer. He is now co-owner of Camco Gas Lift Company at Odessa. He is a member of API and AIME.

Survey Coordination

Aids Bottom-Hole Pressure Tests

A METHOD of controlled shutin pattern and scheduling of wells for bottom-hole pressure surveys, whereby a minimum of well interference is encountered, has been used for several years in the Fullerton field, Andrews County, West Texas. The method was worked out by the Fullerton Field Engineering Committee, a cooperative group composed of engineering representatives from each of the 26 operators in a field of approximately 600 wells producing from the Clearfork of Lower Permian at 7200 feet. The committee employs a paid statistical staff and is supervised by non-paid officers elected from the membership.

The schedule, which is simple to derive and easy to use, is made by ruling the field map in tiers ½ mile wide. With 40-acre spacing, 2 rows of wells across the field make up a tier. Vertical columns are placed at the side of the map (Figure 2, next page) with a single number representing the date in each column opposite each tier. The first column shows the day of the month the wells in the tier are to be shut in. The second shows the date on which bottom-hole pressure bombs are to be run in that tier after a suitable buildup period. The third shows date the wells in each tier may be re-opened. This latter date is the second day after the wells are tested. By leaving each tier of wells shut in an additional day after testing, the wells in the adjacent tier are protected from interference while their bottom-hole pressures are being determined, since they are in the center of a strip 1½ miles wide in which all wells are shut in. The map is reproduced inexpensively and copies are distributed among the field personnel for easy reference of the various operators.

Bottom-hole pressure charts are scanned in the field for an approximate reading and these results are called in daily to the committee for coordination. Because the wells remain shut in an extra day following running of the bomb, there is time for a test to be rerun in case the coordinators find evidence of possible error in that day's reported pressures.

Bomb Calibration Chamber

Since pressures are measured by the individual operators, each with his own bomb, a method of calibration is used which assures consistency of calibration accuracy. Each operator is requested to clean, adjust and calibrate his own bomb during the week prior to the time it is to be used in the survey, thereby determining any need for repairs in ample time. If standby bombs are to be used, these also are checked. When the survey starts, calibrations are conducted by the committee in a centrally located field laboratory. For this purpose a chamber is used in which five 1¼-inch outside diameter bombs may be calibrated simultaneously.

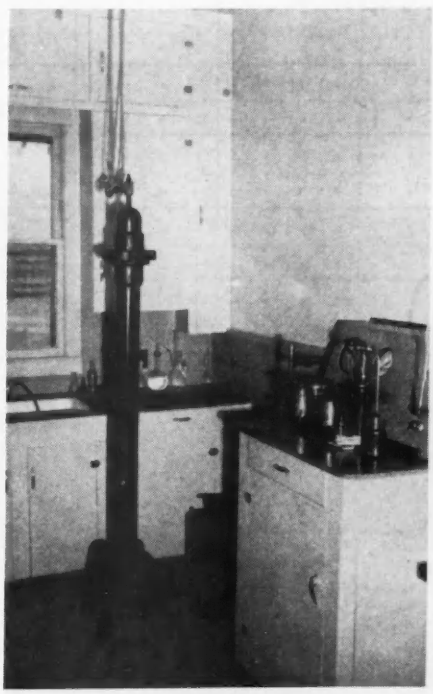

FIGURE 1. In order to assure consistency of bomb calibration accuracy, all bombs used in the periodic field surveys are tested at regular intervals in this bomb calibration chamber. Five bombs at a time each equipped with clock and chart as it would be when run in the well, are clipped to a spacing rack and lowered into the chamber. After the chamber is closed, oil is admitted and pressure built up within the chamber by means of the dead-weight tester visible at right. Following completion of the calibration run, charts are examined and compared to previous calibrations. Any indications of irregularity that may show up on the chart are checked before bomb is run in the field.

The bombs, equipped with clocks and charts as they would be when run in the well, are clipped to a spacing rack and lowered into the chamber. This chamber (Figure 1) is closed with a quick-operating rubber gasketed union which holds high pressures when slightly more than hand-tight.

The chamber is filled with oil by applying compressed air to the oil supply reservoir. By means of a dead-weight tester hand pump, pressures then are applied to the chamber by desired increments over the range which will be encountered in the field. This calibration technique varies somewhat from conventional techniques in that test pressures are applied to the bomb externally, thus simulating actual conditions that the bomb encounters in the bottom of the well. Calibration temperatures are recorded, but no temperature bath is used although this control could be used if desired. A typical test chamber run consumes only slightly more time than would be required in a conventional bomb calibration. A person well versed in the calibrating technique conducts the operation at scheduled times, not less than 3 times a week. Calibrations are requested as frequently as possible on each instrument with a minimum of once per week. Extensions on the charts are measured immediately and compared to those made on previous calibrations for any indications of irregularity.

The combined efforts of the survey participants to use comparable methods, and to follow the procedure as closely as possible, have been gratifying. It is believed that results of bottom-hole pressure surveys have more than justified, in the 5 years during which the system has been practiced, the slight additional effort involved in carrying out this plan.

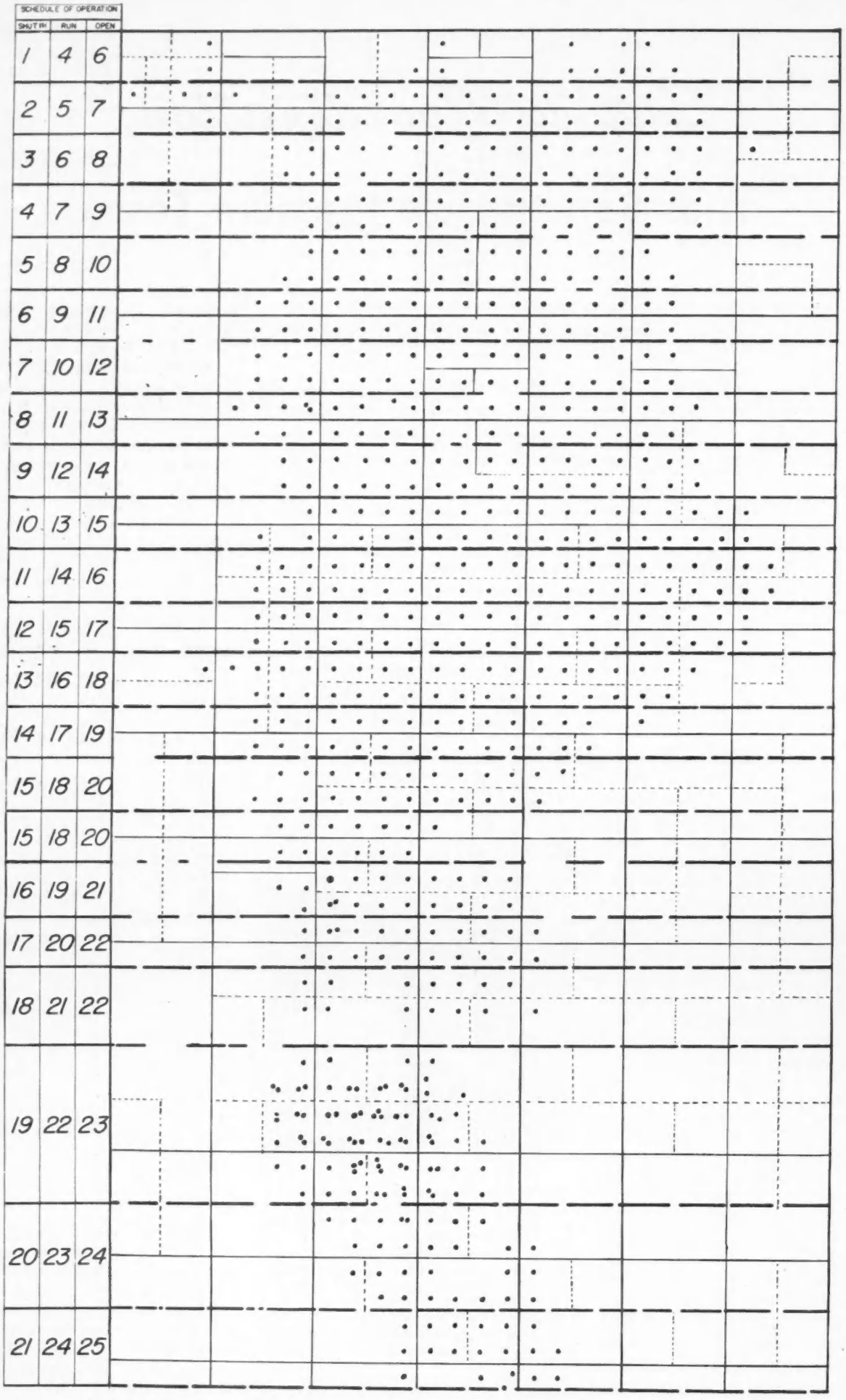

FIGURE 2. Map of Fullerton field, illustrating manner in which field is ruled off in tiers.

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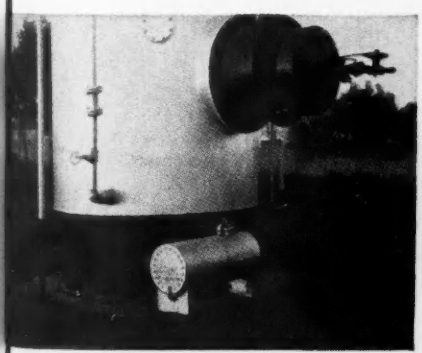

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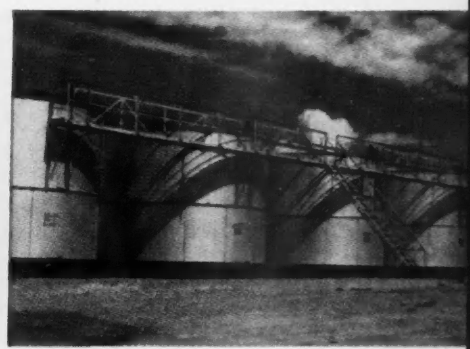

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Core Analysis Technique

For Limestone And Dolomite

FIGURE 1. This was a limestone core into which plastic was forced under high pressure. The core was then treated with acid and the limestone was eaten away around the sides leaving the plastic that entered the pore space. This shows that there is pore space of almost every shape and size and that there is no definite pattern of porosity.

By L. C. LOCKE and JACK E. BLISS

Rotary Engineering and Manufacturing Company, Inc., Midland, Texas

DETERMINATION of solution cavity volume in limestone and dolomite through displacement and re-saturation provide data indicative of total capacity of formation, as contrasted to directional core analysis, which may be unreliable, due to heterogeneity of pore system.

TO EVALUATE properly any pressure maintenance or secondary recovery project, adequate data of permeability and porosity are essential. Obtaining these data is relatively simple in homogeneous sands and the procedure is fairly well standard among all operators. However, the measurements of permeability and porosity of non-homogeneous limestone and dolomite cores is an entirely different problem, and requires a different approach altogether. Due to the non-homogeneous nature of the limestone and dolomite formations, it is impossible to select a sample plug for porosity and permeability determinations. Recognizing this fact, a new method has been developed whereby the entire core is analyzed as a whole for porosity and permeability, thereby presenting data of greater accuracy than has heretofore been available.

Porosity exists in limestone and dolomite formations in 3 distinct types. By injecting plastic into evacuated cores and dissolving the lime away after the plastic has become solid, these types and patterns of porosity can be observed (Figure 1.) This procedure reveals that the most homogeneous cores in appearance are not homogeneous by any means. Small barriers are existent in apparently homogeneous limestones that yield no permeability on any directional flow measurement.

Vugs and voids exist that are

About the Authors

JACK E. BLISS received his B.S. degree in Electrical Engineering from Colorado University in 1933. For the next 6 years he worked for the Geophysical department of Amerada Petroleum Corporation. In 1939 he joined the Well-logging department of Baroid Sales Division, National Lead Company. In 1944 he resigned from Baroid to become co-founder of Rotary Engineering Company of Midland, Texas. He has been active in developing hydrocarbon well logging and limestone core analysis.

L. C. (JACK) LOCKE attended Tarleton State College, Stephenville, Texas, and Texas Technological College, Lubbock, Texas. He worked for Core Laboratories from 1941 to 1947 and for Magnolia Petroleum Company in production, then the Engineering Laboratory in Dallas in 1947-1948. He has been associated with Rotary Engineering Company in Midland, from 1948 to date as manager of the Core Analysis department. He was one of first engineers to recognize need for analyzing cores for non-directional permeability of limestone and dolomite cores in the Permian Basin.

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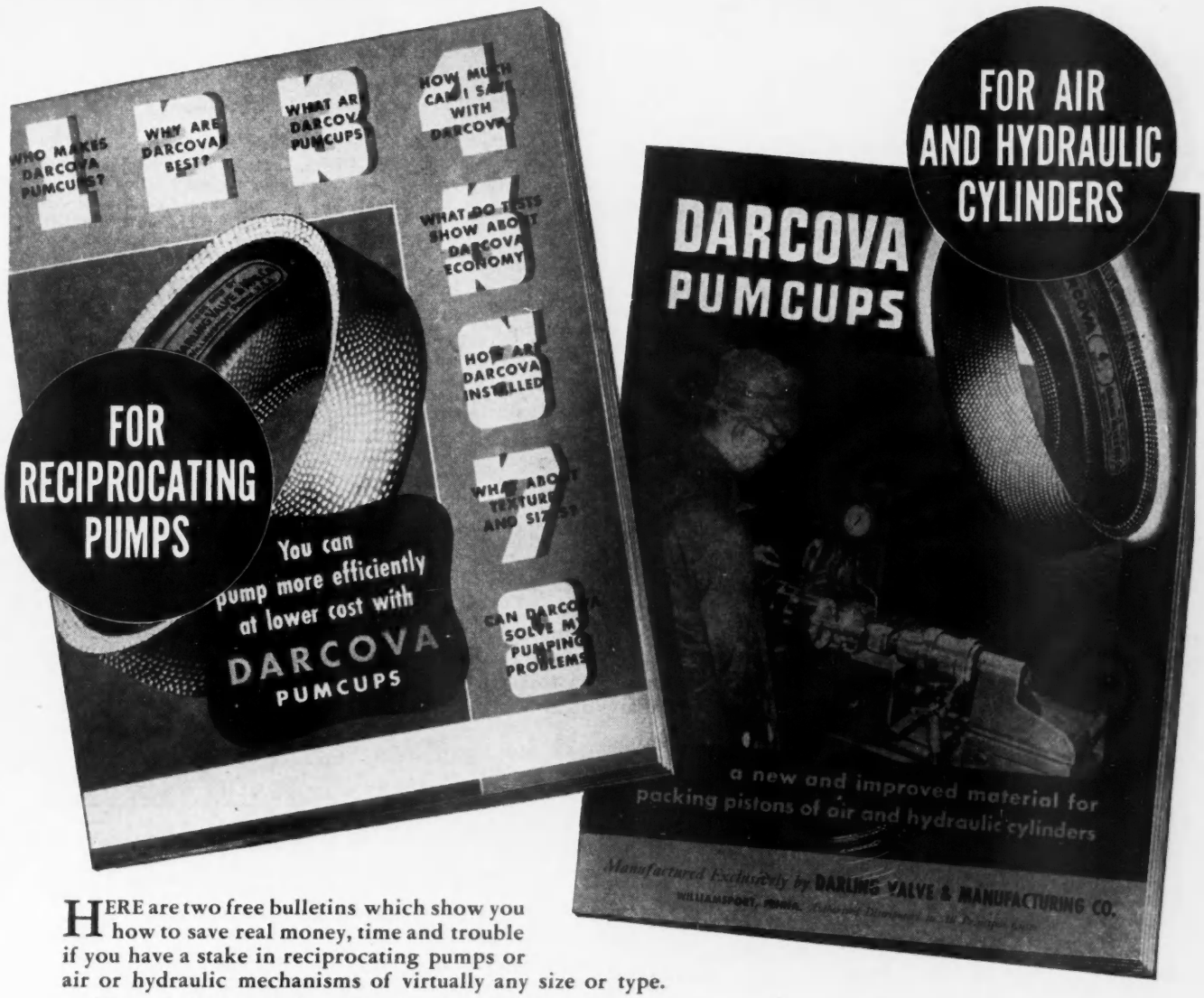
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FIGURE 2. Cores from Devonian limestone formation. Vugs comprise most of the pore space in 4 of these cores. The core on the right is a more homogeneous limestone with intercrystalline porosity. In this case the porosity of the intercrystalline core is about 3 times as great as the porosity of any of the other 4 cores.

FIGURE 3. Cores of fractured Ellenburger formation, showing original fracture at the top of core to the right and fractures incurred in coring at the top of core to the left.

irregular in shape, size, and direction. These solution cavities form a greater part of the effective pore space in some of the reservoirs in the Permian Basin and act as channels for fluid from the tighter intercrystalline pore space to flow into the well bore.

Fractured chert, limestone, and dolomite reservoirs are not uncommon in the Permian Basin. Fluids contained in reservoirs of this nature also follow the path of least resistance through this type formation; therefore, directional permeability measurements are of little value since there seems to be no uniform pattern of fracturing.

By using the entire core rather than selected plugs, an analysis has been developed whereby accurate measurements can be made of

(1) Total volume of the reservoir,
(2) Total permeability,
(3) Permeability distribution in percent, and
(4) Location of permeable porosity in the formation.

The cores are cut into convenient lengths up to 2 feet, and extracted in specially designed extractors to remove water and oil. If desired, saturation data can be taken at time of extraction. The procedure of analysis then calls for the cores to be dried in heat-controlled ovens to remove solvent and prepare them for permeability and porosity tests. After this step the cores are placed in a high pressure cell and evacuated. The vacuum is released and fluid is allowed to enter the core; the volume of fluid entering the core at one atmosphere is measured against time. After the core has taken as much fluid as it will from vacuum to atmospheric pressure, additional pressure is applied in small increments; the volume of fluid entering the core for each of these pressure increments is measured and the time required to inject the volumes is also measured. This is continued until 1000 pounds per square inch pressure has been applied. The total volume of fluid injected is

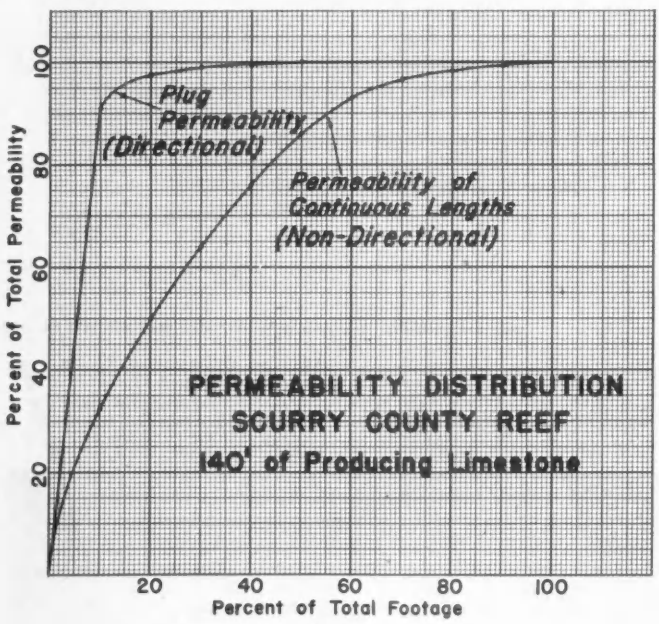

FIGURE 4

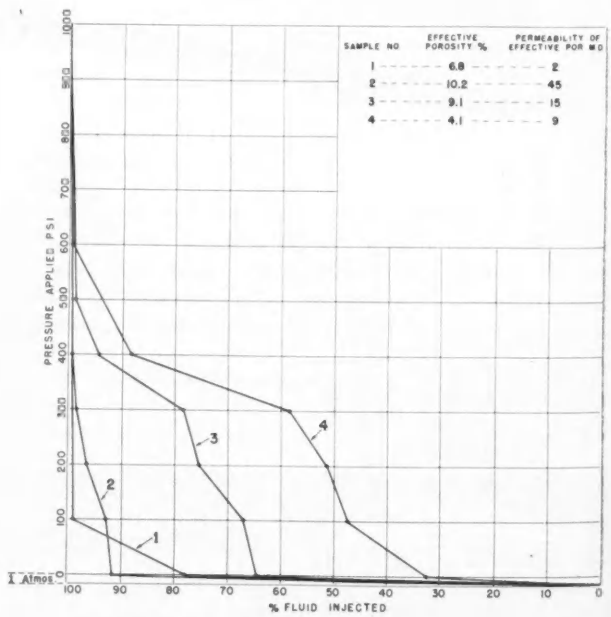

FIGURE 5. Resaturation curves of core samples.

assumed to be the effective pore space.

The volume injected against pressure and time is a measurement of permeability. This measurement is non-directional since the pressure is applied on all sides equally, and the fluid is allowed to enter by the path of least resistance.

Permeabilities measured by this procedure check very closely with measured PI data on wells where such data were available. The permeabilities of the Canyon Reef are not so erratic as plug or directional permeability measurements indicate. Permeability distribution curves (Figure 4) give a true picture of the contrast in the results obtained in measuring permeability by the 2 different methods. Resaturation curves (Figure 5) where percent pore space resaturated is plotted versus applied pressure give some indication of pore size distribution and the percent of the pore space where fluids would be mobile.

Although this innovation of core analysis is in its infancy reservoir engineers are now putting it to practical use in calculating pressure maintenance and secondary recovery in limestone and dolomite reservoirs.

TABLE 1
Permeability Comparisons
SCURRY COUNTY REEF

Sample No.	Plug Permeability	Permeability of Continuous Lengths
1	>0.1	3
2	>0.1	17
3	>0.1	46
4	600	73
	4*	
5	30	79
	10*	
6	111	51
	6*	
7	>0.1	31
	8*	
8	1	28
	6*	
9	6	6
	6*	
10	20	67
	45*	
11	8	49
12	2	80
	9*	
13	21	91
	2*	
14	9	57
	79*	
	252†	
15	1	60
	172*	
	8†	
16	58	81
	75*	
	7†	
17	77	73
	100*	
	54†	
18	19	90
	10*	
19	26	64
	10*	
20	5	69
	194*	
21	178	68
	10*	
22	9	77
	7*	

* Denotes second plug cut and analyzed for permeability.
† Denotes third plug cut and tested for permeability.

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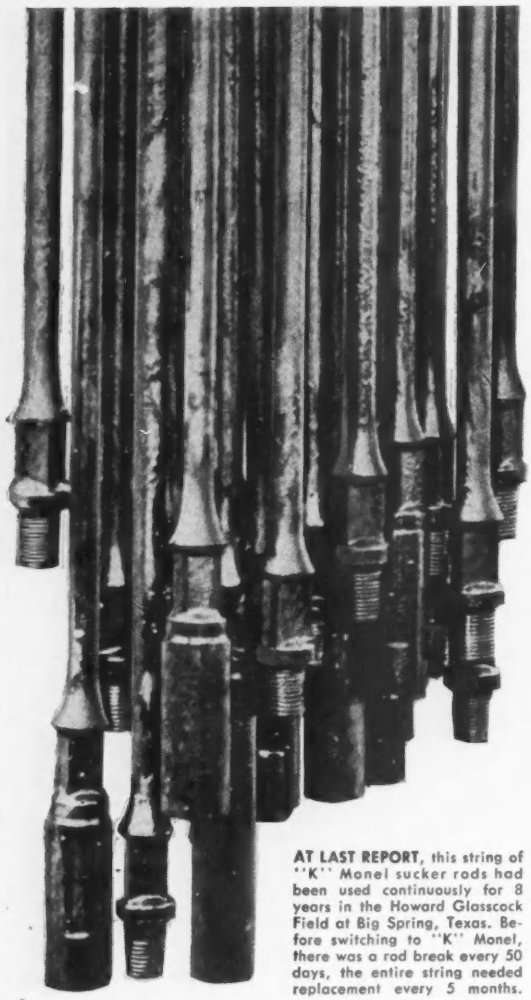

AT LAST REPORT, this string of "K" Monel sucker rods had been used continuously for 8 years in the Howard Glasscock Field at Big Spring, Texas. Before switching to "K" Monel, there was a rod break every 50 days, the entire string needed replacement every 5 months.

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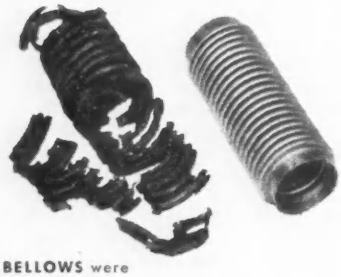

THESE TWO BELLOWS were used in a gas lift valve in the same sour well. Photo at left shows condition of the best previous bellows after 19 days. Compare this with other photo, taken of a Monel bellows when it was removed for inspection after 141 days of use.

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By WALTER D. POWERS
Assistant Division Engineer
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Slaughter Field Problems

Increase Operating Costs

SINCE the discovery well was completed in October, 1936, the Slaughter field of West Texas has developed to the extent of 2221 wells producing from 74,250 acres. Most of the field is in Hockley and Cochran counties, a small segment of the field extending into Terry County.

The wells are spaced according to a 40-acre pattern, but because of the nature of original land surveys, the actual acreage assigned a well is somewhat less than 40 acres, and the maximum unit used for proration purposes is set at 35.4 acres. Field rules permit further development to a 20-acre spacing, and some infill drilling has been done to conform to this pattern, each well being assigned a maximum of 17.7 acres.

Cumulative production to January 1, 1949, amounted to 130,609,000 barrels. Allowables are assigned on the basis of acreage and potential, and the current field allowable is 55,161 barrels of oil per producing day.

The 32-degree API gravity oil comes from a monoclinal structure in the San Andres dolomite of Permian age, at depths varying from 4850 to 5050 feet. The pay section is obviously subject to considerable variation over the large area involved, but this oil producing section may be divided, with few discrepancies, into three zones. Numbering the zones from the top of pay, the first zone consists of the top 55 to 58 feet of brown porous dolomite. This is followed by 5 to 8 feet of gray dense dolomite. The second zone follows, with 44 feet of brown porous dolomite. Below the second zone, 8 feet of gray dense dolomite usually is found. The third zone is composed of brown dolomite with less porosity development and uncertain pay thickness. The third zone has not been penetrated in all parts of the field, and water has been indicated on most of such tests. Only a few tests have indicated oil without water in the third zone.

OPERATORS IN the Slaughter field of West Texas gradually are being confronted with 3 important producing problems which materially affect their operating costs. These problems are (1) corrosion, both surface and subsurface; (2) an increasing gas-oil ratio; and (3) a paraffin problem that appears to be increasing as bottom-hole pressures in the field are decreased. Of the 3 problems, corrosion, particularly of casing strings, is being viewed with major concern by a number of operators. Workover jobs performed thus far have proved costly and it is becoming apparent that techniques will have to be developed for the economical repairing of casing leaks.

Some modifying statements regarding the above definition of the zoning must be added. Pay zones frequently contain dense gray dolomite or anhydrite stringers which reduce the net effective pay, and conversely, the dense gray dividing the zones may be very thin and rather difficult to define in the more productive parts of the field. Gamma-ray and neutron logs facilitate zoning to a great extent.

The oil-bearing section is consistently low in average permeability. Productivity indices above 1 barrel of stock tank oil per day per pound differential are rare. The initial bottom-hole pressure for the field is given as 1775 psi. at —1350, although there is considerable justification for a lower figure, 1710 psi. At the end of 1948, the bottom-hole pressure in this volumetrically controlled reservoir had dropped to 1080 psi. average. As might be expected with low and variable permeability, shut-in pressure tests give widely differing results in different parts of the field.

Although the field was discovered in 1936, most of the development occurred

during 1940, 1941, and 1942, and some drilling has been underway since. The first years of production did not develop any serious problems. Corrosion was evident, but not severe. From the first it was clear that water encroachment would never become a serious matter, and the water produced with the oil was disposed of by evaporation. Except for a few wells drilled into gas caps, gas-oil ratios offered no difficulties. It was found that heating the oil to approximately 135° F. would take care of practically all of the emulsions found, although some chemical might be needed. Paraffin was present, but was much easier to deal with than in other fields, as for example, in the Panhandle field.

Developments during the past 2 years indicate that production prior to 1948 was deceptively easy, and that operators in the Slaughter field now are approaching a period of higher operating costs. The factors leading to this conclusion are discussed in more detail in the following paragraphs.

Corrosion has appeared in many different ways in the Slaughter field. One of the first evidences of corrosion noted was the failure of fire tubes in heater-treaters. These tubes are generally corroded and pitted on the fluid side until a hole appears. At first this was attributed to corrosive fluid recovered from acidizing. However, the corrosion has continued long after residual acidizing fluid would be expected to be present. Most operators have not found this particular form of corrosion to be extremely expensive, and the tubes are replaced in 3 to 5 years. One company is experimenting with various types of metallic anodes as protection for the fire tubes and the heater-treaters in general.

Wells in the Slaughter field were drilled with rotary tools, and a long salt section was penetrated. This caused the drilling mud to be saline throughout most of the rotary drilling operation. In some cases, the mud remained in the well cellar and around the surface connections after the well was completed. The salty nature of this fluid accelerated the corrosion of the well-head and surface connections, making it necessary to clean cellars and paint surface connections with rust preventive paint to arrest this corrosive condition.

Aerated brine and basic sediment in the presence of acidic gases do considerable damage to steel stock tanks. Tank bottoms and tank decks suffer most from these corrosive fluids. Interior coatings of plastic paint and other corrosion preventives have shown some benefit. The plastic gives excellent results if it can be made to bond to the steel, but more study and experiment seem to be necessary before a perfect bond can be assured for each application. The life of a steel stock tank without interior coating is estimated to be from 6 to 10 years.

The old oil field custom of putting basic sediment and tank residues on roads is beginning to cost money from a corrosion standpoint. The sour crude oil from the Slaughter field contains 54 pounds of salt per 1000 barrels, and apparently the residues used for road maintenance contain ample corrosive compounds and fluids to cause trouble. It has been observed that flow line corrosion is worse where the line crosses a road that has been treated with waste well fluids.

All forms of corrosion so far discussed become insignificant in comparison with a recent development. Within the past 2 years, holes have appeared in casing strings with sufficient frequency to be disturbing. One of the largest operators in the field has repaired 8 casing leaks, an operator of average size has repaired 4 casing leaks, and 3 have been repaired by a relatively small operator. With few exceptions, the leaks are found above 2000 feet, and frequently appear in the 500- to 1000-foot interval.

FIGURE 1. Photographs of parts of 1700 feet of casing pulled from a well by an operator in the Slaughter field to determine cause of casing leak. Evidences of corrosion are seen in presence of evenly spaced "hot spots," scattered patches of lost metal (visible near pocket knife) and the tendency for threads to break off rather than unscrew.

Cause of Leaks

The cause of the leaks has not been determined positively. As previously mentioned, the casing was cemented in salt mud, with the top of cement outside the casing rarely above 3500 feet, or 1300 feet above the casing shoe. The coating of salt mud above the cement could be an excellent electrolyte. Corrosive characteristics of this mud were probably increased by entrainment of oxygen from the air while the mud circulated through pits. Another line of thought involves the fact that, in many cases, outlets in the bradenhead between the surface pipe and the oil string were not closed, and oxygen may have entered these outlets, penetrating downward as the mud level outside the casing receded.

Before the full extent of the problem

was realized, one operator cut off and pulled about 1700 feet of casing in which a leak had developed. This string was not studied as closely as it would have been if the problem had been better recognized at that time. Photographs of this string of casing (Figure 1) show the presence of evenly spaced "hot spots," and the tendency for threads to break off rather than unscrew. Scattered patches are evident where considerable metal has been lost. However, the hole causing the trouble was found in a coupling, in spite of the fact that more metal had to be removed before a hole appeared.

Problems attendant with the repairing of a shallow casing leak in the oil string are much more serious than a first glance would reveal. As an example of these difficulties, the actual operations on a Slaughter field well are described.

Leak Repair Problems

The well was originally completed in March, 1941; 9⅝-inch surface casing was set at 408 feet; 7-inch oil string was set at 4835 feet, and total depth was 4990 feet. The oil string had been cemented in an 8¾-inch hole with 275 sacks. In June, 1949, appearance of oil in the cellar indicated a hole in the casing. The hole was located at 831 feet, and the casing was bridged at 3958 feet. The casing was then perforated at 1406 feet with two ½-inch holes, and a retainer was set at 1356 feet. Pumping into the perforations proved that circulation could not be broken to the surface from that depth, and the perforations were squeezed off with 75 sacks. The casing was again perforated at 856 feet, and a retainer was set at 790 feet. Using 400 sacks, cement was circulated to the surface, then squeezed until a maximum standing pressure of 1500 psi was reached. The retainers, cement, and bridge plug were drilled out, and the pipe tested. The well was placed on production in an apparently satisfactory condition.

In less than 6 months, the casing pressure was observed to be much less than it should have been, and a check revealed that the old perforations at 1406 feet were taking fluid. A bridge plug was set at 3721 feet and a retainer set at 1340 feet. Two stages of cement were applied, with a maximum standing pressure of 2250 psi. A total of 159 sacks was placed outside the 7-inch casing in the two stages. However, when the retainer and cement were drilled out, a leak still was indicated by pressure test. Another retainer was set at 1355 feet, and, while pressuring the annulus above the retainer preparatory to squeezing, a leak developed in the casing above the retainer. Squeeze operations were discontinued, and the retainer and bridge plug were drilled out. A bridge plug was set in the bottom of the 7-inch casing and a string of 5-inch OD 15 pounds per foot N-80 extreme line casing was set at 4783 feet. Cement was circulated to the surface between the 7 and 5-inch casing strings. After drilling out, the well was put back on production in a satisfactory condition.

Survey Results

A gamma-ray and neutron survey made on the well before running the 5-inch casing indicated that the casing had ripped from 1420 to 1440 feet, and several rough spots were revealed by the collar locator.

From the described operation, it was concluded that there may be as much as 1000 feet of section containing corroded pipe, and that squeeze cementing is an unsuitable means of repair, especially at these shallow depths. It is further concluded, in spite of the recognized hazards of such an operation, that it would be better procedure to cut off, wash over, and recover the corroded pipe, then replace it with new casing on which a protective coat has been applied. Connection to the pipe remaining in the hole would be made by means of a casing bowl.

In new wells, some companies are circulating cement to the surface on the original oil string cementing operation as protection against corrosion. It has been shown that perlite mixed with gel cement improves the fill efficiency of such an operation by reducing the weight of the cement.

It may be that the occurrence of these casing leaks within a few months of each other was purely coincidental, and if additional leaks do not develop, the matter will appear much less serious. At this time, however, corrosion is regarded with major concern.

Gas-Oil Ratios

Several factors combined to make gas-oil ratios an increasingly serious problem. The slight dip of the producing formation does not permit appreciable migration of released solution gas to gas cap areas, and local secondary gas caps tend to form. The natural expected performance of a gas expansion type reservoir under conditions of reducing liquid saturation inevitably results in higher ratios. Most wells in the Slaughter field with which the writer is familiar have a marked tendency to accumulate gas rather than oil with extended shut-in time, and it has been shown by sonic methods that there is a distinct depression of the fluid level in the casing with increased shut-in periods.

Gas-oil ratios in excess of 2000 cubic feet per barrel result in penalties in allowables, in proportion to the size of the ratio. For example, a well with a ratio of 4000 cubic feet per barrel receives half the allowable normally assigned to it. This penalty system has resulted in numerous workovers, many of which have been successful.

The nature of the producing formation, a long section of hard dolomite separated at intervals by dense barriers, enables operators to use packers successfully. As most wells are open-hole completions, formation packers are frequently used. Although it would seem simple to obtain a formation packer shut-off, it is generally necessary to seal a packer before a complete shut-off is obtained. As packer seal material, bentonite mud containing materials generally used for loss of circulation are applied. Oil-base drilling mud containing perlite is regarded with increasing favor for this purpose. Regardless of the type packer seal material used, the method of application is generally the same. About 10 barrels of the fluid are pre-

About the Author

WALTER D. POWERS, born in Greeley, Colo., attended Colorado School of Mines, graduating with degree in petroleum engineering in 1939. He spent some time, both before and after graduation, doing general field work for Stanolind Oil and Gas Company in the Pampa, Texas, area, and in 1940 started with the company as apprentice engineer. He was advanced to petroleum engineer at Odessa, Texas, in 1941 and to field engineer at Imperial and Wink, Texas, in 1943. In January, 1947, he joined Sid W. Richardson, Inc., as district engineer in the Slaughter district, with headquarters at Sundown, Texas. On April 15 of this year he was promoted to assistant division engineer for the Richardson interests in the West Texas division, with headquarters at Kermit, Texas.

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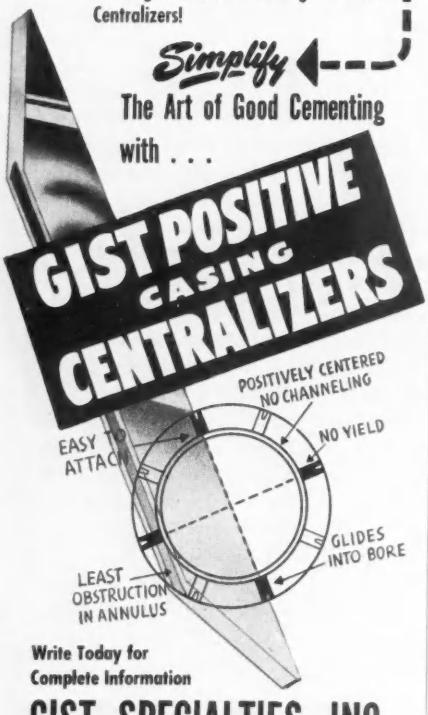

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pared and pumped into the annulus. No attempt is made to displace the material to the packer, since the annulus of a high ratio well contains little fluid above the packer.

Many wells have been deepened to control gas-oil ratios, and the gas-oil ratio problem has resulted in considerable exploration of the third zone. Deepening has proved to be a good solution to the ratio problem if favorable formation can be found and if the newly penetrated section can be successfully acidized. The latter difficulty arises on all deepened wells, as the upper zones were acidized on initial completion with as much as 10,000 gallons. The newly penetrated formation has natural resistance to the penetration of acid, and some means must be found to encourage the acid to enter the newly drilled section. Pilot control of various types has been used, but many operators favor the use of packers, set at the top of the new section. The use of packers results in good acid jobs if the direction of the pressure differential across the packer is controlled.

Pumping oil into the casing and allowing it to enter the previously acidized section has met with indifferent success in holding down a packer, and results in long swab operations after the treatment. Perlite has been used in these operations, also, to temporarily plug off the permeable parts of the previously acidized section so that more pressure will develop and less fluid will be used in maintaining proper differential across the packer. Another method utilizes a cup packer in addition to the formation packer. The cup packer is installed in the acidizing string in such position that it will set in the lower part of the casing. Drill pipe or heavy tubing is used between the two packers, and also for anchor below the formation packer. The formation packer is further expanded by increasing the downward force upon it in excess of the weight of the tubing string, by applying additional pressure to the cup packer from the surface.

In relatively low pressure areas of the field, wells that flow with high ratios frequently show significant ratio decreases when pumping equipment is installed.

Some operators report gas-oil ratio reductions accomplished by means of producing high ratio wells at high bottom-hole pressures, using intermitters.

Paraffin

It may be said that most of the usual methods of paraffin control have been applied during the producing period of the Slaughter field. Mechanical scraping by means of wire line equipment seems to be losing ground in favor of hot oil treatments and soluble plugs. Paraffin does not cause the same degree of difficulty in all parts of the Slaughter field. Many leases located in higher pressure areas give no difficulty whatsoever. Those wells located in low pressure areas accumulate paraffin to such an extent that regular paraffin removal schedules are in order.

Paraffin in flow lines offers a serious problem if the flow line is of small diameter. Two-inch ID flow lines require continuous attention, but one operator with 4-inch flow lines has not had a line paraffin-up to date.

Pumping

A count made in November of 1949 revealed that there were 647 wells pumping in the Slaughter field. Of the 647 wells, 160 wells were pumped hydraulically, and the remaining 487 wells were pumped with beam-type equipment.

There are few wells on pump in the Slaughter field that do not flow at least part of their production and in many cases, it is necessary only to agitate the well briefly to start sustained flow. This condition has led to reports of exceptionally long pump runs. However, conditions are favorable for long pump runs in the future when the present assistance gained from natural formation pressure becomes negligible. The fluid pumped contains no abrasives, very little water is produced and, so far, no evidence of extreme pump corrosion has been seen.

Previous reference has been made to the high differential required for oil to flow from the formation to the well bore through the dolomite. From this fact alone it can be concluded that Slaughter field wells will go on pump at relatively high bottom-hole pressures, and a long pumping history will follow before operations reach an economic limit.

Future Outlook

As a convenient fraction, approximately 1/3 of the ultimately recoverable oil has been produced in the Slaughter field. Certainly this will prove to be the oil that was recovered with the least expenditure. Corrosion will cause increasing expenditures, and gas-oil ratios will require additional attention. As pressures are further reduced, paraffin will become more of a problem. The entire South Plains area is concerned with the problem of fresh water supply for domestic purposes, and this problem may yet become important in oil producing operations. However, these problems appear no worse than those in many other Permian Basin fields, and Slaughter field prospects are equally as bright. With improved technology and advances that may be expected in the future, the Slaughter field should produce profitably for many years to come.

Gas Lift

Principles and Practice

Part 3

By C. D. FLETCHER
Sales Manager, Merla Tool Corporation

WELLS having a very low fluid level and low productivity, where the bottom hole pressure is insufficient to feed to a height for a closed type of installation, are usually produced with an accumulation chamber installation (Figure 5). It is also used when the working level is below the casing seat or in open hole.

This type installation accumulates the low fluid head in a chamber larger than the regular tubing string and lifts the fluid from the chamber with injected gas. The lifting point of the gas is the bottom of the dip tube inside the chamber which can be placed close to the bottom of the hole.

A hook-wall packer is run and set. Immediately below the packer the tubing is swaged out to the largest possible size pipe that can be used according to the diameter of the oil string and open hole beneath. Length of the chamber is determined by the well productivity. The bottom of the chamber is swaged back to regular tubing size and a standing valve installed. Below the standing valve, a perforated nipple is run.

Immediately above the packer the bottom intermitting valve is placed. Above this valve a hanger or bug nipple is run in the tubing string. A dip tube, usually 1 or 1¼-inch, is suspended from the hanger nipple to approximately 12 or 18 inches above the standing valve. A bleed port, 3/32 or ⅛-inch in diameter, is bored in the top collar of the dip tube.

In operation, the chamber is filled with fluid from the producing formation. Injection of surface gas in the casing annulus opens the operating valve above the packer. Gas is injected into the chamber on top of the fluid, forcing the fluid downward in the chamber annulus, up through the dip tube, into the well tubing and to the surface. After the cycle is completed and the valve is closed, pressure in the chamber bleeds off into the tubing through the bleed port in the top collar of the dip tube permitting the chamber to refill with fluid.

Installation With Tail Pipe

This installation (Figure 6) is similar to the accumulation chamber with dip tube in that the chamber is run in the same manner but the hanger nipple and dip tube combination is not used. A special valve mandrel is used having an adapter at the entry port to accommodate the size tail pipe used. The tail pipe is suspended from the mandrel adapter and extends to the bottom of the chamber as in the dip tube installation.

When the valve is opened for an injection cycle, gas enters and is conducted to the bottom of the chamber through the tail pipe. In this type installation, gas enters the chamber under the chamber fluid, whereas, with the dip tube gas enters the chamber on top of the fluid.

No bleed port is required in the tail pipe.

With the accumulation chamber installation shown in Figure 7, the intermitting valve is placed in the bottom of the chamber instead of above the packer. Packer is run and accumulation chamber is installed below the packer with a standing valve and perforated nipple in the bottom of the chamber.

Immediately above the packer a cross-over tee is run in the tubing string. From this cross-over tee a dip tube extends to the bottom of the chamber and the intermitting valve is adapted to the end of the dip tube.

In operation, injected gas enters the crossover tee and passes through the dip tube to actuate the intermitting valve at the bottom of the chamber.

This type installation is advantageous in that the intermitting valve may be surface controlled by a pressure reducing regulator. Weight of fluid above the valve governs its opening pressure. With this feature the operation of the installation can be easily regulated to maximum gas-fluid ratio.

When a well is equipped with 7-inch OD casing and 2-inch EUE tubing an accumulation chamber can be run that will have a full size tubing opening at the bottom of the chamber. (Figure 8.) This permits the running of bottom-hole survey instruments, also the use of a removable type standing valve.

A 7-inch OD × 3-inch EUE hook-wall packer is used. Above the packer a 3-inch EUE × 2-inch EUE hanger nipple is run in the tubing string. The operating intermitting valve is placed on a 3-inch EUE tubing mandrel. This permits a 2-inch tail pipe to be suspended from the hanger nipple to the bottom of the accumulation chamber. A bleed port is placed in the top collar of the 2-inch dip tube.

This type installation provides less friction than when smaller dip tubes are used.

Full Size Casing Chamber With Two Packers

Where well casing is run through and perforated or set immediately on top the producing formation, and the size of the casing does not permit running of a chamber sufficiently large to contain the desired fluid heads, the full size of casing can be used as an accumulation chamber (Figure 9).

A hook-wall packer is run on the bottom of the tubing string. A standing valve and perforated nipple are placed immediately below the packer. Another perforated nipple is run immediately above the hook-wall packer. An anchor packer is run and spaced above the hook-wall packer to form the desired chamber volume.

The operating valve is run above the anchor packer. A crossover nipple is run in the tubing string immediately below the anchor packer. A short dip tube connects the inlet port of the

operating valve with the crossover nipple. A bleed port is placed in the tubing immediately below the anchor packer.

The operating valve opens and injects gas into the dip tube. Gas passes through the crossover nipple into the casing annulus on top of the fluid, forcing it downward through the perforation above the hook-wall packer and upward through the crossover nipple to the surface.

The installation shown in Figure 10 is similar to that in Figure 9. It accomplishes the same purpose, i. e., utilizing the full size of the casing as an accumulation chamber.

Two opposing pressure cups are run on the bottom of the tubing. A hook-wall packer is run and spaced above the pressure cups to form the desired chamber volume. A standing valve and perforated nipple is run at or below the pressure cups. A perforated nipple is run immediately below the hook-wall packer and another perforated nipple run immediately above the pressure cups.

The operating valve is run above the packer and a hanger nipple installed in the tubing string above the operating valve. A short dip tube is suspended from the hanger nipple with 2 smaller opposing pressure cups on the bottom of the dip tube. The dip tube is of sufficient length to place the pressure cups below the top perforated nipple. A bleed port is placed in the top of the dip tube.

The operating valve opens and injects gas into the annulus between the dip tube and tubing. Injected gas enters the chamber through the top perforated nipple. Gas pressure forces the fluid downward in the chamber, through the lower perforated nipple, up the dip tube to the surface.

Accumulation Chamber Above Packer

In certain wells it is advantageous to place the accumulation chamber above the packer (Figure 11). This is a closed type installation with the bottom intermitting valve immediately above the packer. Between the bottom valve and the valve above it, an accumulation chamber is run, length and size according to the well characteristics. This type chamber accumulates the fluid in the tubing above the valve and when the operation cycle is made, fluid in the chamber is forced into the smaller tubing above the chamber. This creates a

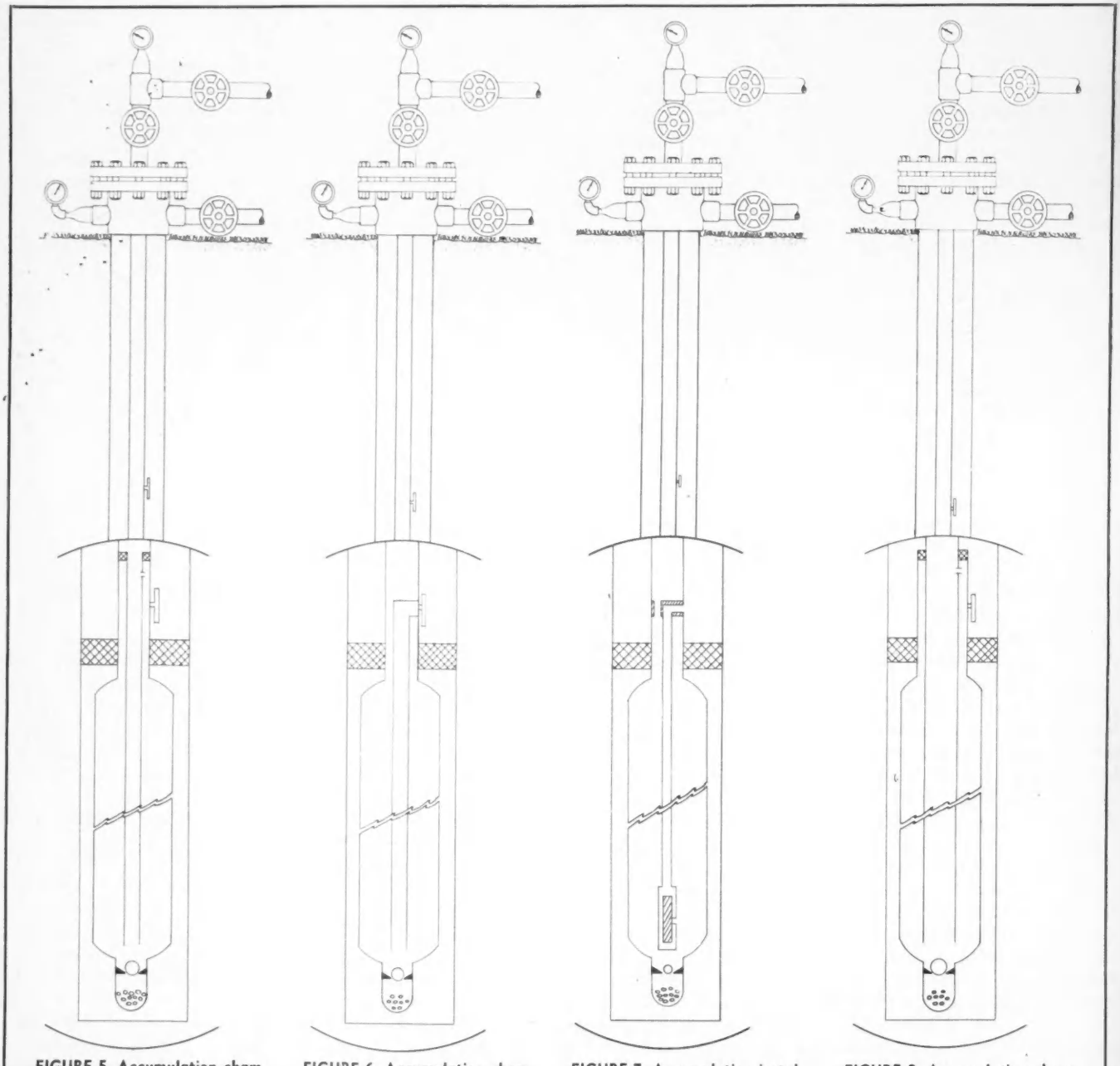
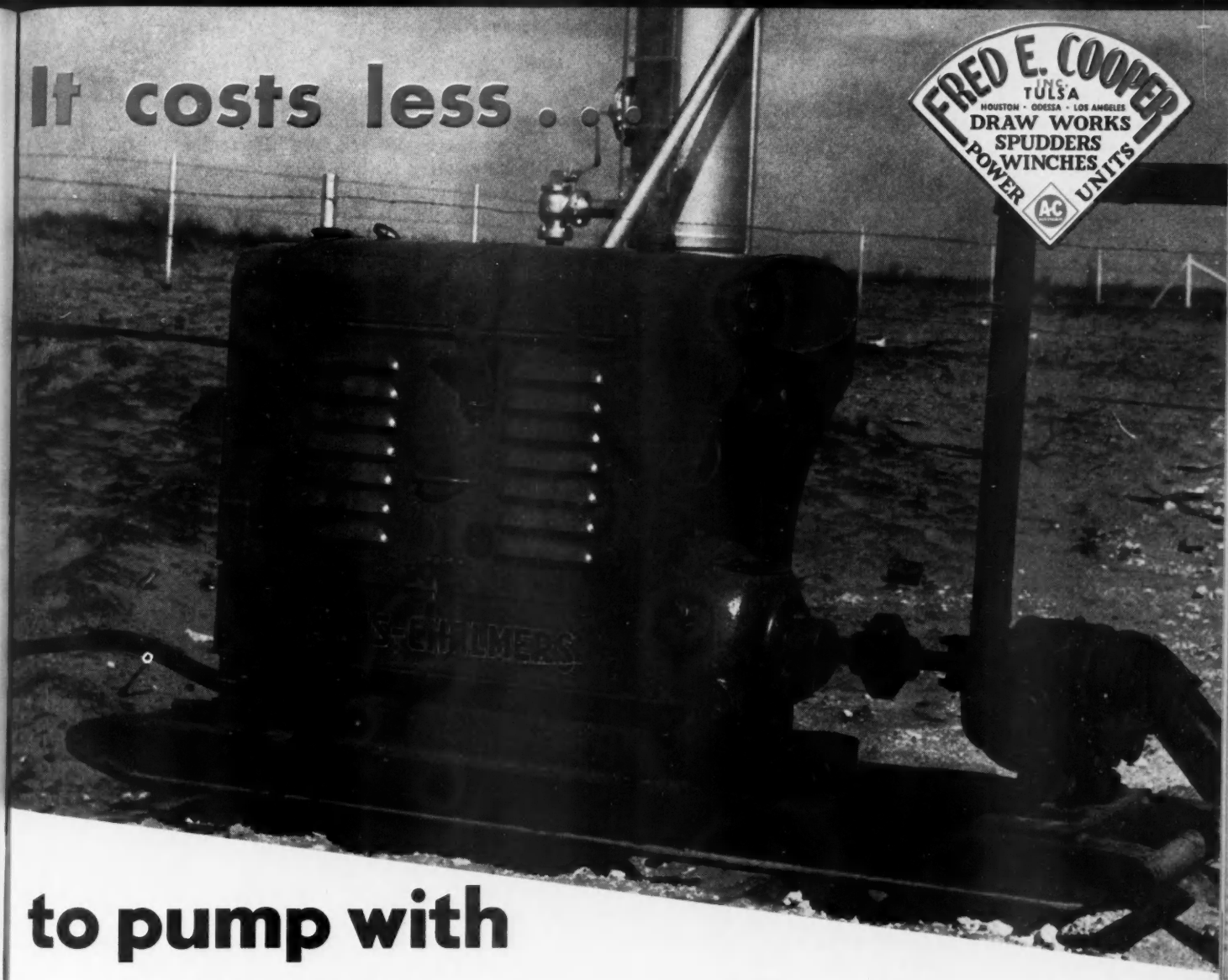


FIGURE 5. Accumulation chamber installation (with dip tube).

FIGURE 6. Accumulation chamber installation (with tail pipe).

FIGURE 7. Accumulation installation with intermitting valve at bottom of chamber.

FIGURE 8. Accumulation chamber installation for bottom hole surveys.



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longer head of fluid that is easier to move in the eductor tube with a minimum of aeration.

This installation is especially effective in wells having a high bottom-hole pressure, comparatively low fluid productivity and exceptionally low fluid gradient, fluid usually in the distillate class.

The open installation (Figure 12) is used in wells having a high bottom-hole pressure and high fluid productivity. Intermitting valves are run in the tubing string and no packer is necessary. Standing valve, perforation or open ended tubing is optional. Fluid in the casing annulus is permitted to surge with the varying annulus pressure. Full effect of the annulus pressure is obtained in the U-tubing of fluid.

The lowest valve is positioned at a sufficient distance from the bottom of the tubing to prevent the operating pressure from blowing around the bottom of the tubing. Fluid between the bottom valve and bottom of the tubing assures a seal for intermitting operation.

The lowest valve exposed to annulus pressure will be the operating valve. This permits the working level of the well to be at the lowest possible point according to pressure used and productivity of the well.

This type installation permits back pressure against the producing formation. It is used only where such a condition will not affect the producing ability of the formation. Generally speaking, this type well is beyond the limits of intermitting valve operation and is produced with automatic differential or continuous flow valves if the working level is not beyond the limit of their working depth.

Dual Completion Installations

In dual completion wells, a condition which sometimes occurs is that one zone continues flowing through the casing annulus and the zone being produced through the tubing ceases to flow.

Under this condition, a string of small macaroni tubing, (Figure 13), is run inside the well tubing with valves spaced on the macaroni tubing to gas lift the production from the tubing zone. These valves are adaptable for either intermitting or continuous flow operations.

The valves can be adapted to mandrels so that gas can be injected down the

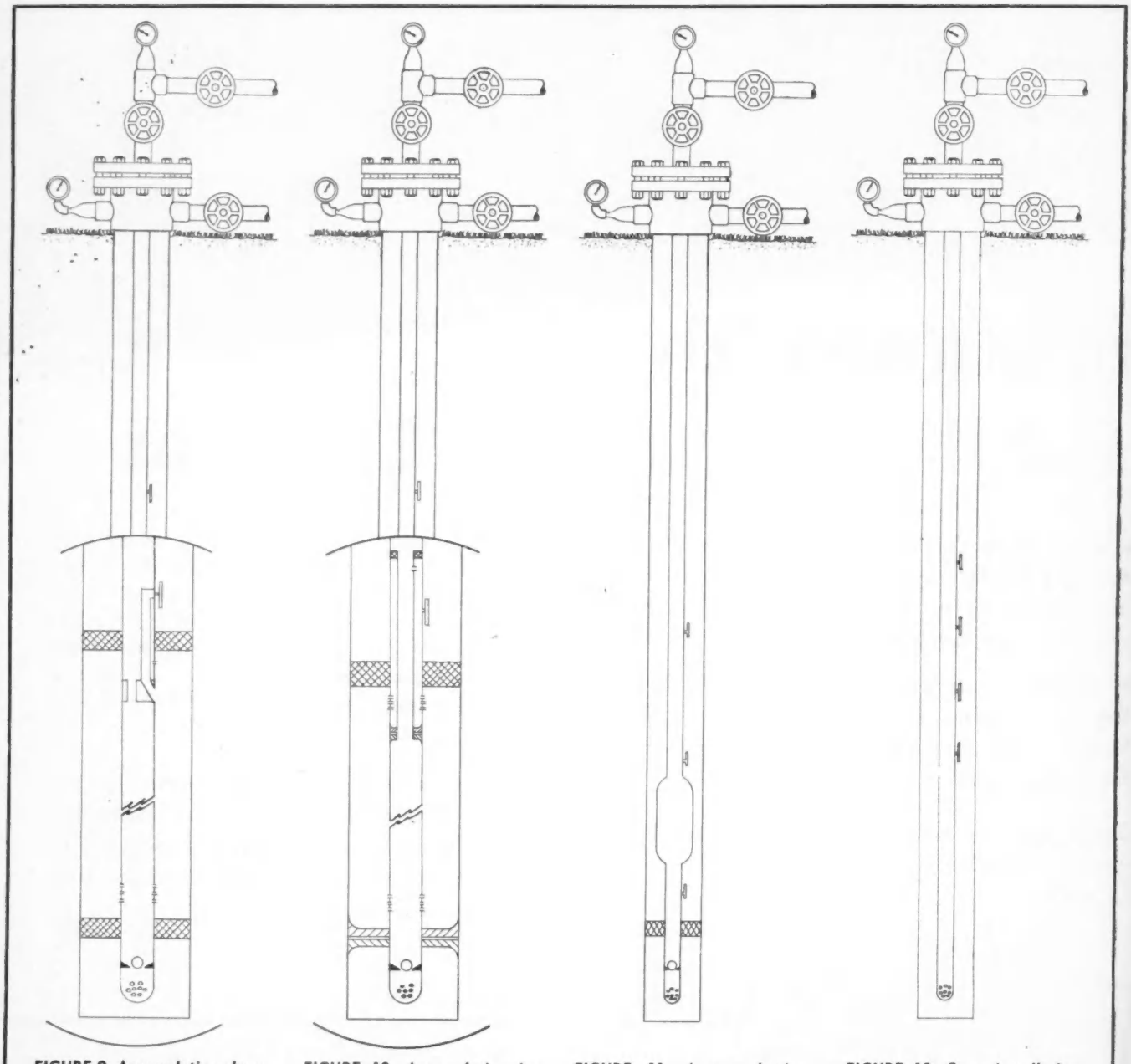

FIGURE 9. Accumulation chamber installation (full size casing chamber with 2 packers).

FIGURE 10. Accumulation installation (full size casing chamber with pressure cups).

FIGURE 11. Accumulation chamber above packer.

FIGURE 12. Open installation.

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macaroni string and fluid produced in the annulus between the macaroni string and the tubing; or gas can be injected down the annulus between the macaroni string and the tubing and fluid produced through the macaroni string.

Gas lift equipment for producing dually completed wells is being developed (Figure 14). By adapting the various types of equipment available to the individual well characteristics, the artificial lifting of production from a dually completed well may be accomplished.

Basically, the usual practice requires the use of 2 tubing strings inside the oil string. The larger tubing string is run with a packer set between the producing zones. The smaller tubing string is run inside the larger, and a packer is set on the smaller string.

Gas is injected into the annulus between the two strings of tubing. Valves mounted on the larger tubing introduce gas into the annulus between the well casing and the large string of tubing to produce the upper zone. Valves mounted on the smaller tubing introduce gas into the smaller tubing to produce the lower zone.

There are so many variations of equipment such as crossover packers, side door chokes, various types of packers, etc., also the many individual well characteristics and problems to consider that it is impossible to discuss them in detail. It is recommended that a competent gas lift engineer be consulted when a dual gas lift problem is encountered.

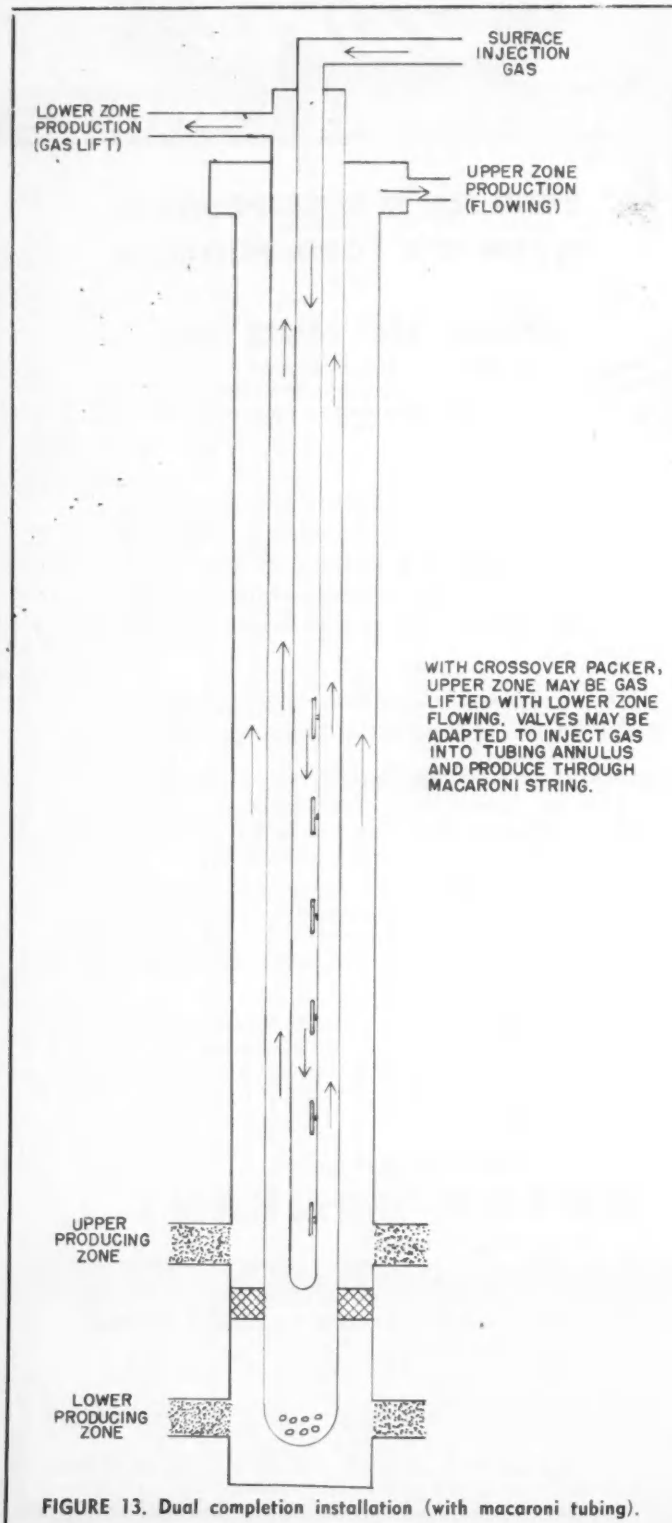
SURFACE INJECTION GAS
LOWER ZONE PRODUCTION (GAS LIFT)
UPPER ZONE PRODUCTION (FLOWING)
WITH CROSSOVER PACKER, UPPER ZONE MAY BE GAS LIFTED WITH LOWER ZONE FLOWING. VALVES MAY BE ADAPTED TO INJECT GAS INTO TUBING ANNULUS AND PRODUCE THROUGH MACARONI STRING.
UPPER PRODUCING ZONE
LOWER PRODUCING ZONE

FIGURE 13. Dual completion installation (with macaroni tubing).

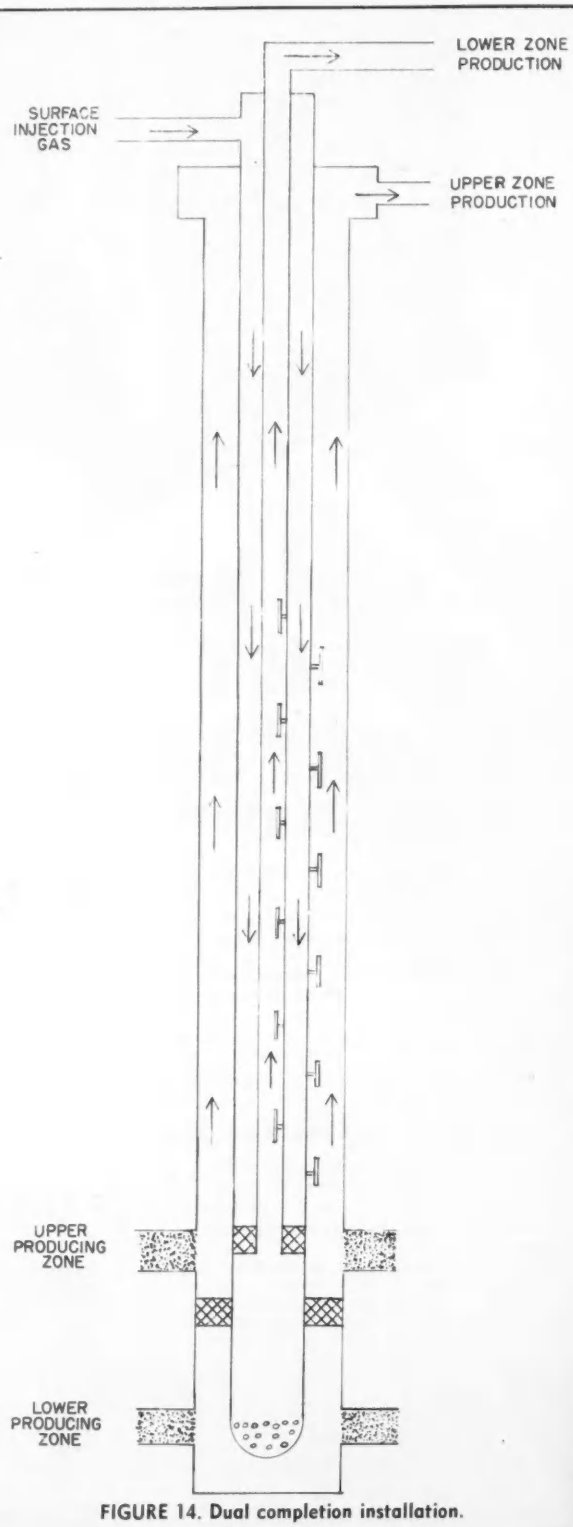

FIGURE 14. Dual completion installation.

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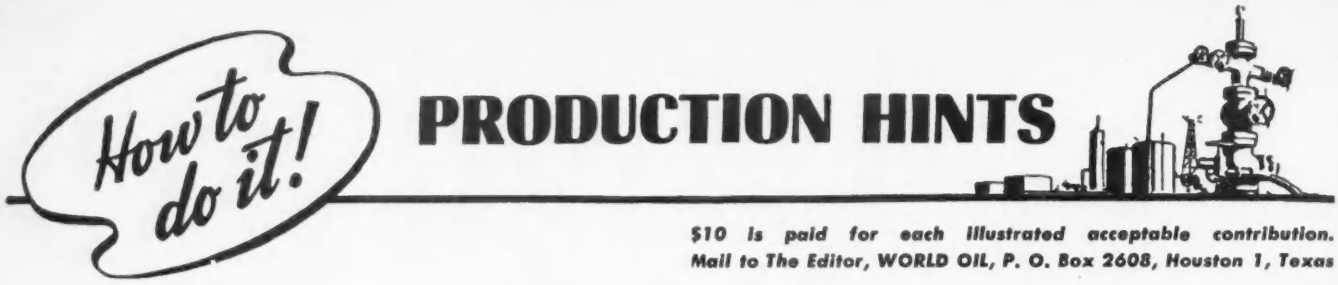

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HOW TO—Provide Handy Well Data Sheet

Keeping track of 32 wells being pumped by electrically-driven units is a big job for any pumper, and particularly so when it is necessary to keep a balanced electrical load on a central generating unit. Because some wells make more fluid than others, it is necessary to compensate their pumping time in order not to permit any well to make more than its allowable.

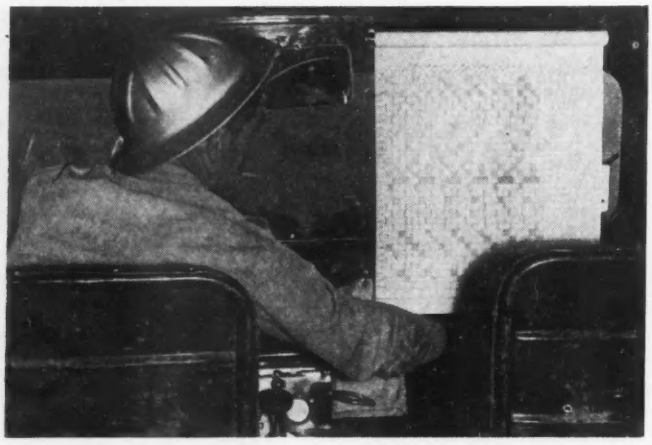


Photo courtesy Shell Oil Company.

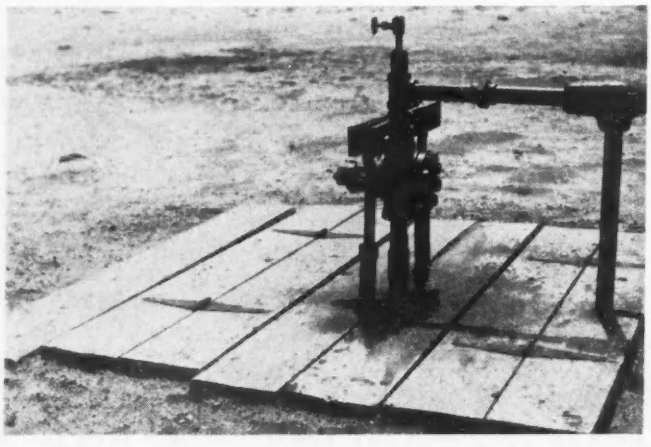
The job of starting and stopping 32 wells is greatly facilitated by the application of a well pumping time chart. This time chart is worked out so that the load on the central generator is nearly constant, yet each well is made to pump its allowed production. Such a chart provides a clearly understood and easily followed method of keeping track of all 32 wells.

In addition to the pumping cycle for each well, additional data on the chart shows 100 percent pumping capacity, number of strokes per minute, length of stroke, etc. This information presented graphically on a single chart eliminates the need for a set of instruction books which are bulky, become dirty and may lead to misunderstanding.

All the above-mentioned information is placed on a heavy cloth material that forms a curtain on the window-shade device illustrated. The wooden rod on which the curtain is coiled is spring loaded and acts similarly to a roller shade. This device is mounted above the windshield inside the pumper's field jeep and on the passenger side, but convenient to the driver. By pulling down the curtain, the pumper quickly refers to the data chart for positive data on any one of 32 wells. The curtain feature kept the chart clean and the information readily available.

HOW TO—Reduce Cellar Cover Maintenance

A problem commonly associated with the use of planks for covering cellars of producing wells is the abuse sometimes given them, with individual planks being misplaced or removed entirely from the well. Such planks usually are carefully fitted so that they lie close to each other, with notches cut out where well fittings are brought above the surface.



One company operating in the Permian Basin area installs large strap hinges on some of the planks in their cellar covering, the hinges being so placed that only certain of the planks can be raised for inspection or work on fittings in the cellar area.

Other planks, particularly those that are notched and fitted around the well head and risers are spiked to the collar of the cellar.

The practice is one which costs little when the original installation is made, but which materially reduces subsequent maintenance and replacement costs of such coverings.

The practice also adds to the safety of personnel working around the lease, as there is less chance of the planks lying crooked and thus becoming a stumbling hazard.

ALLIS-CHALMERS

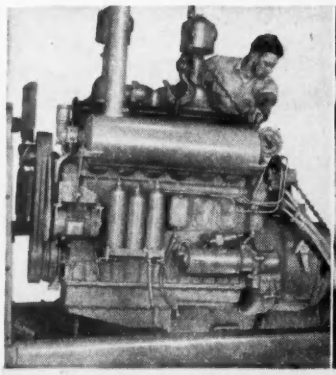
Design Simplicity

Another Big Reason Why HD-19 Leads in Tractor Output

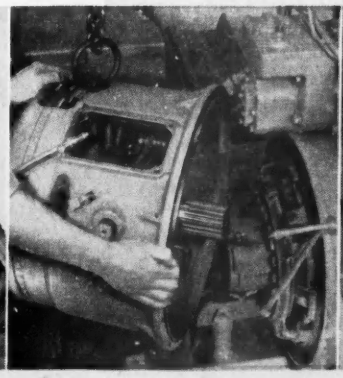
Gears, pinions and bearings by the dozen have been eliminated in the HD-19. This means fewer parts to wear — fewer breakdowns and fewer repair bills.

When maintenance is necessary, each assembly is readily accessible for attention. The HD-19 is designed so that each major unit may be easily removed and repaired or replaced *right on the job* without removing unrelated parts. The time and labor saved means substantial increases in the HD-19's over-all output. Remember, a tractor makes money for an owner only when it's working.

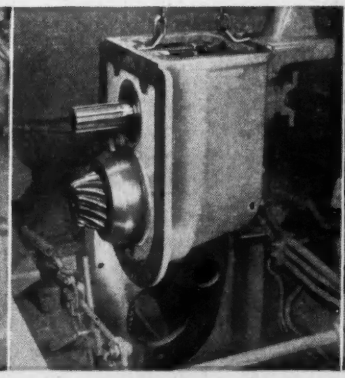
Simple unit assembly is another important reason why the HD-19 is low in total down time required for servicing and maintenance—why it's tops in output per day, per month, per season.



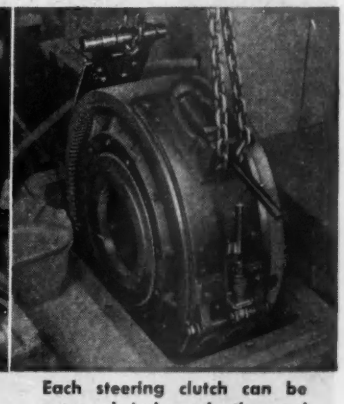
Engine can be removed without disassembling clutch.



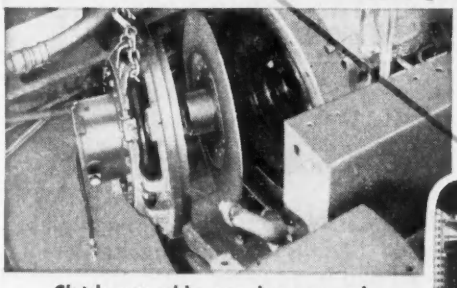
Transmission can be removed as a complete unit without removing clutch, final drive or bevel gear.



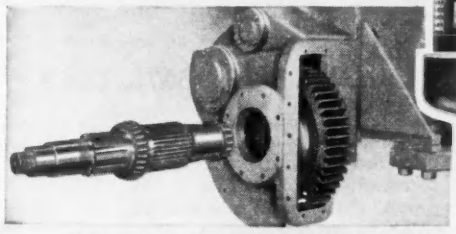
Torque converter can be removed without disturbing engine or transmission.



Each steering clutch can be removed independently and without disturbing final drive or bevel gear.



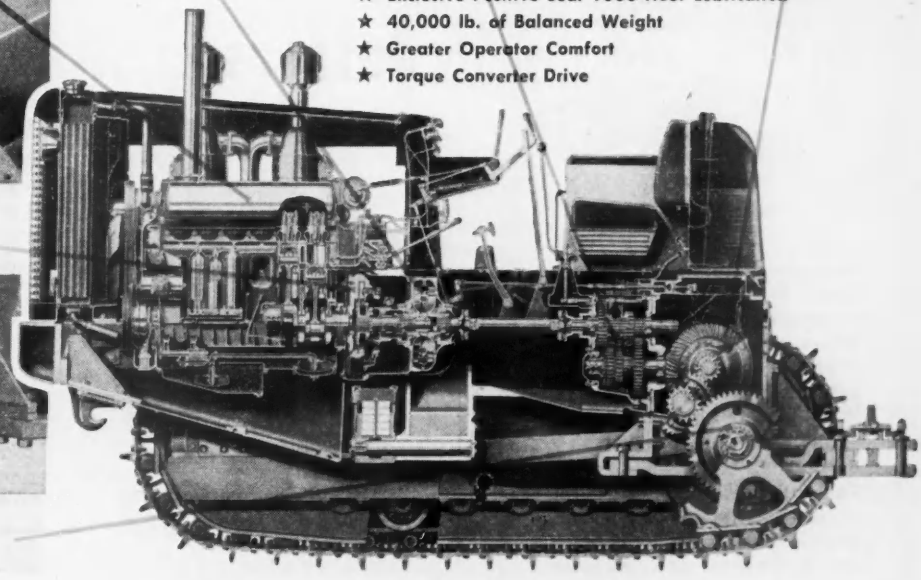
Clutch assembly can be removed without disturbing either engine or transmission.



Final drive gear and intermediate gear can be removed without disturbing steering clutch.

MORE REASONS FOR HD-19 TOP PERFORMANCE

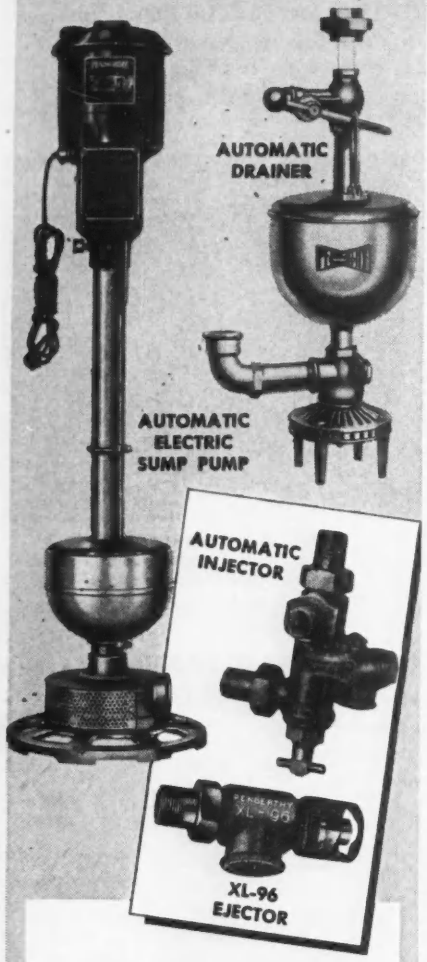
- ★ Exclusive Positive Seal 1000-Hour Lubrication
- ★ 40,000 lb. of Balanced Weight
- ★ Greater Operator Comfort
- ★ Torque Converter Drive



ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

PENBERTHY
Quality Products



Penberthy Automatic Electric Sump Pumps and Penberthy Automatic Drainers (water or steam operated) have demonstrated their superiority wherever seepage water accumulates. Simple rugged design—copper and bronze construction throughout.

Penberthy Automatic Injectors assure an uninterrupted supply of feed water to oil field boilers at minimum cost. Reliable under most severe operating conditions.

Penberthy Ejectors use the power of steam, air or water under pressure to lift liquids. No moving parts—no lubrication. Also used as water heaters.

3277-A

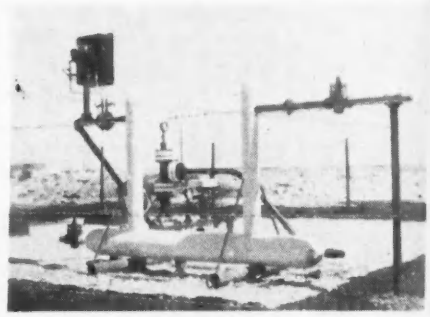
PENBERTHY INJECTOR CO.
Detroit 2, Mich.
Canadian Plant—Windsor, Ontario

HOW TO—Build Portable Scrubber

It is necessary to keep gas used in gas lift operations as clean of liquids and foreign matter as possible to prevent clogging injection valves placed in the tubing string. A simple but effective scrubber unit cleans the gas economically at the well head.

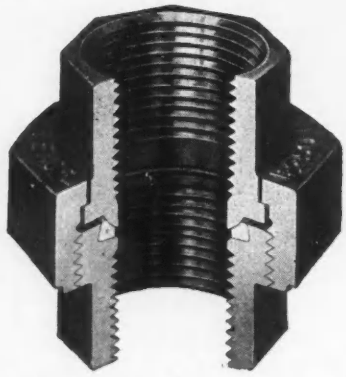
The scrubber unit illustrated differs from the ordinary unit in that it utilizes 2 vertical scrubber members rather than just one. Its construction readily lends itself to quick setup and moving from one well to another.

It consists of a section about 10 feet long of 12¾-inch casing, orange-peel welded at either end, terminating in a 2-inch collar. Two 4-foot pieces of 8⅝-inch casing form the 2 vertical scrubber elements, and are welded into the horizontal member about 2 feet from either end as shown. A short piece of 2-inch pipe is welded at right angles to the vertical section and terminates in a hammer union, making connections at both inlet and discharge easy and quick.



The scrubber rests on 2 pieces of 4-inch pipe tack-welded to the bottom of the horizontal member. Pieces of sucker rods added to either side of each vertical unit provide adequate bracing. A valve is placed in the far end of the larger section so fluid may be drained or foreign material blown out. The enlarged scrubber permits the gas velocity to decrease, thereby dropping out entrained particles. It facilitates the gas lift operation and provides clean gas for injection.

Jefferson Malleable Unions



JEFFERSON'S *EXCEL* unions and union fittings available in brass-to-iron, and iron-to-iron seats. Certified Air Furnace iron used in the EXCEL line is A.S.T.M.-4733-Grade 35018 malleable, having a 53000 lb. Min. Ten.

EXCEL—
250 lb. S.W.P.—500 lb. C.W.P.

Certified Air Furnace iron produces a constant, uniform, finer grain structure union. This provides a much better iron with which to produce a positive dependable seating surface.

Unions manufactured from this malleable iron give 30% more strength; 50% more impact value; 75% more elongation. Sizes ¼" thru 3".

Obtainable through your jobber

Jefferson Union Company, Inc.

591 West 26th St.,
New York 1, New York

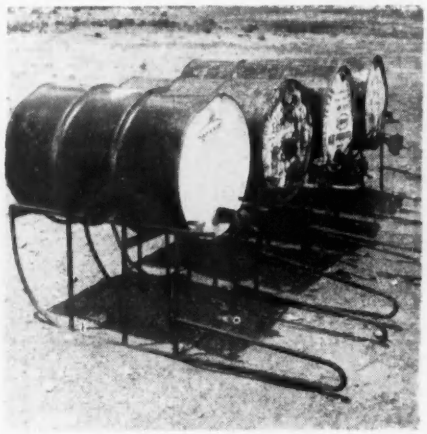
71 Gooding St., Lockport, New York
31 Fletcher Ave., Lexington 73, Mass.

PRODUCTION HINTS

HOW TO—
Construct Improved Rack for Oil Drums

Numerous drum racks have been devised by as many field men, the prime objective being to design a rack that will enable one man to move, lay down or tilt up a full drum of oil with the least possible exertion and possibility of injury to himself. One company has devised improvements to drum racks which add greatly to their utility. Among these improvements are (1) a rocking-chair type of base which facilitates rolling them up or down with little effort; (2) extended handles which give the man much more leverage when handling a full drum; and (3) an adjustable latching device which effectively secures the upper part of the drum to the rack. These features are visible in the racks shown.

The latching device, two of which are used on each rack, is a piece of flat



metal cut into an L-shape and welded to a pipe sleeve that can be slid up or down on the projection of the longitudinal members on which the drum rests. When the rack is in an erect position beside the drum, the latches are slipped down over the lip of the drum top, enabling the man to devote his efforts toward tipping the drum over and without his having to reach through the rack to hold the drum close to it as he pulls the rack down to its horizontal position.

The rack is made of salvaged sucker rod materials and is unusually rigid. Its cost is repaid many times in all field operations requiring the handling of oil drums. Although much time is saved in the routine handling of drums, one of the most important considerations is the fact that with this type of rack a workman is less likely to injure himself when full drums are being handled.

AXELSON
FIRST CHOICE

Unquestioned Reliability and Assured Performance

For more than 50 years, Axelson has consistently applied their manufacturing "know how" to practical oil field pumping operations...with the result that Axelson Sucker Rods are considered by petroleum producers to be "first choice" under all pumping conditions.

AXELSON PETROLEUM PRODUCTION EQUIPMENT

WRITE FOR BULLETINS ON: Sucker Rods and Couplings, Pump Liners, Pump Plungers, Balls and Seats, Specific Deep Well Plunger Pump Assemblies, Long Stroke Pumping Units, Pumping Accessories.

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

AXELSON PETROLEUM PUMPING EQUIPMENT

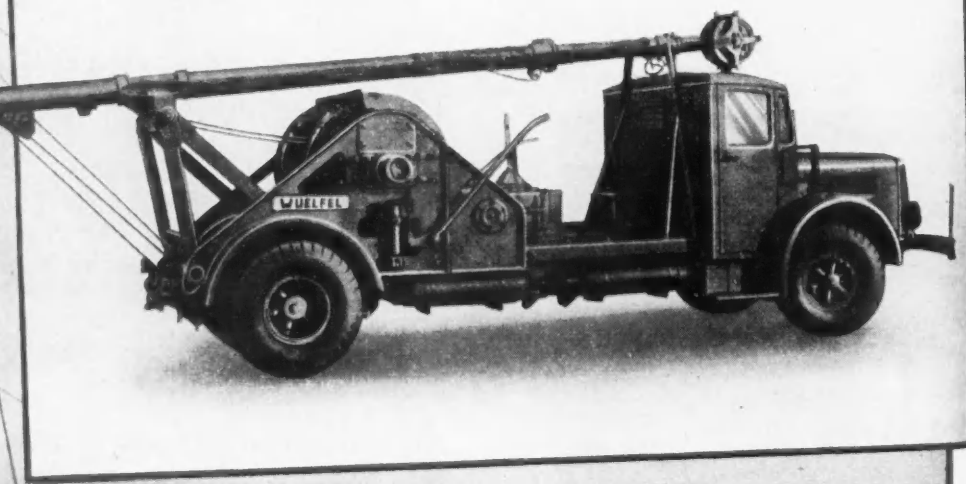
Ask Axelson experts for practical answers

AXELSON MANUFACTURING CO. • PLANTS — Los Angeles 58 St. Louis 16 • OFFICES — New York City 7; Tulsa 1; Buenos Aires, Argentina; Caracas, Venezuela • DISTRIBUTORS — Jones & Laughlin Supply Co.; Great Northern Tool & Supply Co.; Industrial Agencies, Ltd., San Fernando, Trinidad, B.W.I.; Industrias Waldrip & Campbell, Barcelona and Maracaibo, Venezuela; Dominion Oil Field Supply Co., Ltd., Calgary, Canada.

Wülfel

TRUCK MOUNTED HOISTS

Type Aw 100/1 with 105 HP Diesel Engine for a max. line pull of 15,000 lbs., for cleaning, bailing and swabbing operations as well as for pulling of tubings and rods.



Special attachment with rotary and mud pump drive for reconditioning jobs.

EISENWERK WUELFEL · HANNOVER-WUELFEL · GERMANY

HOW TO—Build Self-Closing Gate

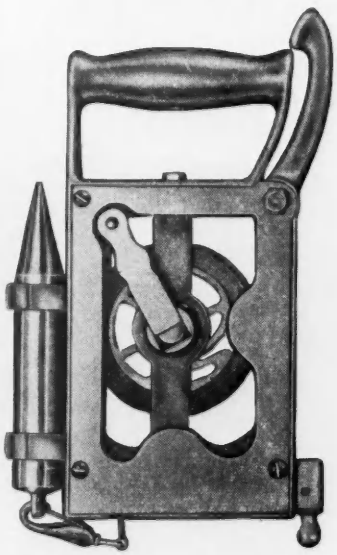
In fields in open range country, keeping livestock out of tank farms or other enclosed yard areas is a common problem. While it usually is possible to build a fence that will keep livestock out, it sometimes is difficult to see to it that gates in the enclosures always will be kept closed by lease personnel. One company operating in the West Texas area, in searching for a gate that would close by itself if the field man happened to leave it open, designed a novel hinge that causes the gate to fall shut by its own weight.

The gate itself is of conventional design, being made of salvaged sucker rod materials. The only unusual feature is the manner in which the lower hinge is secured to the gate post. The hinge pin socket, instead of being welded to the normal position on the post, is welded 90 degrees around and on the outside of the post. The hinge pin also is modified, being given a 90-degree bend and welded in place as shown. Because of this offset hinge, the gate when opened assumes an unbalanced position and tilts in such a way that when the man releases it, it closes of its own weight. The gate is designed to be opened outward, a stop being welded to the other side which prevents it from swinging inward.

it's new — cuts gauging time!

MENKE TAPE LINE HOLDER AND WIPER

Makes Gauging Easier



COMPACT—easy to carry, easy to use.
SAFER—brake feature prevents injury to hands and fingers. Leaves hands free from oil.

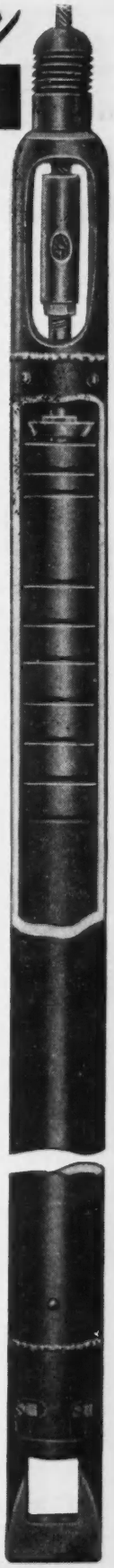
DURABLE—SPARK FREE—aluminum construction—light but strong—will not wear out. Prevents fires by eliminating sparks.

ECONOMICAL — Automatic wiper removes oil from tape. Enables gauger to measure more tanks in much less time. Pays for itself in saving on rags alone.

List Price $9.50. Order from any supply company or send order direct to

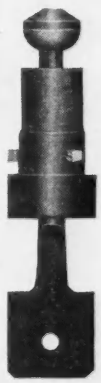
MENKE APPLIANCE CO.
Box 237 MONAHANS, TEXAS

Miller SAND PUMPS



In every major producing area where sand or sediment is a problem, you'll find Miller Sand Pumps and Bailers are standard . . . the leaders in clean-out equipment. For 26 years Miller has held this leadership, with continuous improvements and faithful service.

The Miller Sand Pump is made in regular and heavy duty types in sizes listed below. Lug type, chisel, sand and bailer bottoms are easily interchanged.



SAND PUMP and BAILER SIZES:

Outside Diameters

2½"
3"
3½"
4¼"
5"
5½"
7"

Lengths

20 feet
25 feet
30 feet

Special Sizes and Lengths Made to Order!

Write for new descriptive price list on Miller Sand Pumps and Bailers. See Composite Catalogue Page 3305 for details.

MILLER SAND PUMP CO.
1524 S. E. 29 St. . . . . Box 4516
OKLAHOMA CITY 9, OKLAHOMA

EXPORT OFFICE:
30 Rockefeller Plaza-New York 20, N.Y.

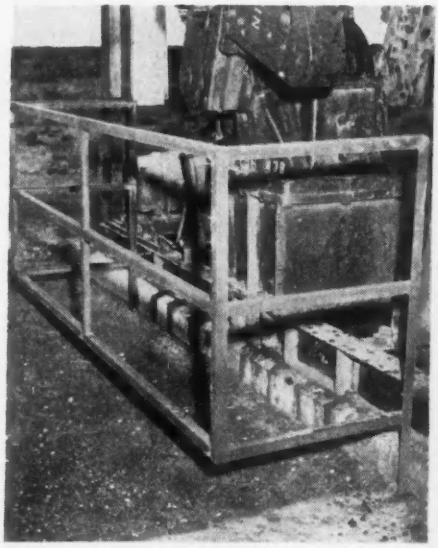
HOW TO—

Make Guard Rail For Counterweight

A pumping unit guard rail of unusually simple design intended to prevent workmen or livestock from accidentally moving in too close to the revolving counterweight, is used by the producing department of one company. Built of light angle iron material and assembled by the welder as a single unit, the guard rail is installed with only 2 bolts. These bolts are laid across the top of the pumping unit structural steel base member at the appropriate points and welded in place. The threaded ends of the bolts project beyond the base several inches and are run through matching holes burned through the corner legs of the guard.

The guard rail design makes use of the fact that it rests on only the 2 inside corner posts, the feet of which are pulled up close to the base of the pumping unit. By cinching up the nuts tightly, the guard rail is held rigidly in place and cannot tip outward.

This type installation is economical to build and can be installed or removed in a matter of several minutes. Absence of the 2 outer corner legs makes it easier for the pumper to keep the ground area clean and free of rubbish.

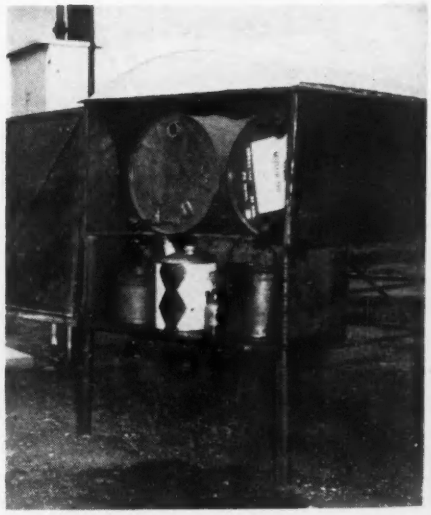


HOW TO—

Construct Central Lube Storage Depot

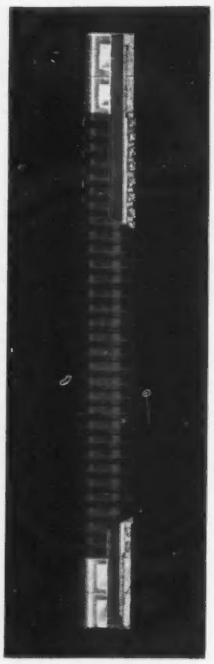
Efficiency of pumpers and other field personnel can be increased materially by providing central points around the lease where extra supplies of lube oil, solvents and other supplies can be stored.

One company in West Texas builds a compact, all-enclosed structure with a capacity of 2 drums laid side by side



Harbison-Fischer
***FLEXITE* Plungers**

Flexite Plunger in H-F Tubing Pumps
Traveling Barrel Rod Pumps
Bottom Hold-Down
Top Hold-Down



Self-Lubricating ☆ Non-Swelling
Corrosion-Proof ☆ Perfect-Sealing

The "step-cut" design of H-F Flexite Plunger rings allows a free-moving action that causes them to expand to a positive seal with the pressure of the fluid load on the up-stroke, and to release gradually on the down-stroke. This free sealing and unsealing action of the rings reduces sudden shock and strain on the pump and rod string. Flexite Plungers are not effected by corrosion, hot salt water, high-sulphur-content, or any well fluid. They are made of a hard, fabric-reinforced plastic impregnated with graphite and will fit all API-standard bore sizes. Available in 20-, 30-, 40-, 50-, and 60-ring lengths at your favorite supply store.

H-F

Harbison-Fischer Mfg. Co.

2501 Virginia St., Ft. Worth, Texas

Rod Pumps ★ Tubing Pumps ★ Polished Rods ★ Polished Rod Stuffing Boxes
Balls-and-Seats ★ 'Flexite' Plungers ★ Wire-Line Oil Savers ★ Hydraulic Tubing Testers

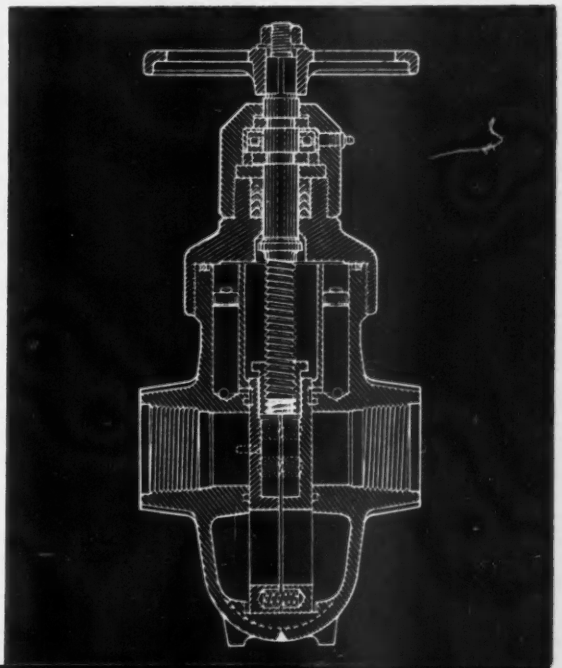
HERE THEY ARE!

The 500 and 1000 lb. W.O.G.

McEvoy

AUTOMATIC LUBRICATION

CONDUIT GATE VALVES



Here are the "little brothers" of the famous high pressure McEvoy valves. They offer all the advantages . . . long life, easy opening and positive sealing . . . of the high pressure valves — yet they are competitive in price to other lower pressure valves.

Be sure to specify McEvoy the next time you order 500 or 1000 lb. valves. You can be sure you are getting the best in valve service.

SPECIFICATIONS—500 lb. working pressure—1000 lbs. test pressure, 1000 lb. working pressure—2000 lbs. test pressure. McEVOY AUTOMATIC LUBRICATION GATE VALVE.

DIMENSION	2" 500-lb. W.O.G.	2" 1000-lb. W.O.G.	2 1/2" 500-lb. W.O.G.	2 1/2" 1000-lb. W.O.G.	3" 500-lb. W.O.G.	3" 1000-lb. W.O.G.
End-to-end measurement	7-3/4"	7-3/4"	10"	10"	10-7/8"	10-7/8"
Floor to center of port	5-5/16"	5-5/16"	6-3/4"	6-3/4"	7-3/4"	7-3/4"
Center of port to top rim of handwheel	10-3/4"	11-1/2"	12-3/16"	12-3/16"	13-1/16"	13-13/16"
Diameter of handwheel	7-1/2"	12"	7-1/2"	12"	12"	11-1/4"
Minimum diameter of opening through valve	2-1/16"	2-1/16"	2-9/16"	2-9/16"	3-1/8"	3-1/8"

This is a two-way valve. It functions perfectly in any position with either end upstream.

ON DISPLAY AT THE PERMIAN BASIN OIL SHOW OCTOBER 19-22 ODESSA

McEvoy COMPANY

TEXAS AND MILBY ST. • P. O. BOX 3127 • HOUSTON 1, TEXAS

Export Representative: E. F. Gahan, Inc., Room 1223, 500 Fifth Avenue, New York, N. Y.

DOES PARAFFIN
Clog your well?
USE
CRALL
SPIRAL
PARAFFIN SCRAPERS
(PAT. REG. U. S. PAT. OFF.)

CRALL Spiral Paraffin Scrapers *eliminate* paraffin accumulation at the lowest possible cost. They are designed to fit any sucker rod for 2" or 2½" tubing . . . are NOT welded to rod, but shrink-gripped around the rod.

CHECK THESE FEATURES

- Scrapers alternate — one right, one left — eliminating tendency of rod to unscrew.
- Pass scrapers every pump stroke, up and down. Rod string does not rotate.
- The first low initial cost is the only cost.

Order your CRALL Scrapered Rods from your supply store or wire, write or phone for full descriptive literature.

PETROLEUM SPECIALTY CO.
P. O. BOX 1640 PAMPA, TEXAS
Manufacturing and Fabricating Plants at Pampa and Sundown, Texas

PRODUCTION HINTS

and an array of smaller cans and miscellaneous articles required from time to time on the lease.

The enclosure is made of salvaged tank sheeting and miscellaneous pipe and sucker rod materials. The drums are placed on an upper shelf and the smaller cans are kept on a narrower, lower shelf, the latter being at the right height to facilitate draining of drums directly into the smaller containers. A tightly fitting door which may be locked if desired and sheet metal eaves along the top of the opening provide good protection from dust and rain. The installation can be designed and built to suit the particular requirements of the lease or area.

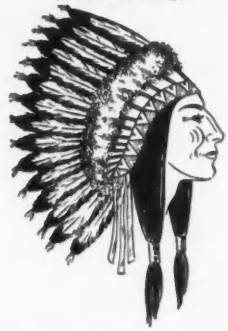
HOW TO—
Reduce Shear on Anchor Block Bolts

When a derrick-equipped well is to be pulled with a portable truck-mounted pulling unit, the unit usually is set up just outside the derrick and the pulling line is run through a snatch block just inside the derrick enclosure. Some operators prefer to have the snatch block attached to a "stinger" or length of pipe projecting from the rear of the pulling

unit and others prefer to anchor the block to a concrete base just inside the derrick enclosure.

On an installation of the latter type, one operator employs a sloping surface on his anchor on which he can mount the snatch block, thus reducing the shear developed on the anchor bolts. Such shear can be an important factor when the well being pulled is 10,000 feet or more deep. In the particular installation shown, 2 short lengths of heavy 6-inch angle iron are set back to back and held in place by heavy anchor bolts embedded in the sloping surface of the concrete block.

CHIEF
PARAFFIN SOLVENT
(Patent Pending)



"Chief of All"
(Copyright 1947)

If CHIEF Paraffin Solvent can take care of the paraffin in the tubing and casing of your wells and the lead lines and tank bottoms on your lease, IT will do three things: First, CHIEF Paraffin Solvent will dissolve the paraffin; Secondly, CHIEF Paraffin Solvent will put the paraffin in solution; Thirdly, CHIEF Paraffin Solvent will keep the paraffin in solution indefinitely.

CHIEF PARAFFIN SOLVENT IS ALWAYS GUARANTEED if used as directed.

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SECONDARY MODERN RECOVERY
TECHNICAL CONSULTING
PRODUCTION ENGINEERING
SERVICE, INCLUDING
CORE ANALYSIS

PRESSURE MAINTENANCE WITH GAS OR WATER

Starting Next Month . . .

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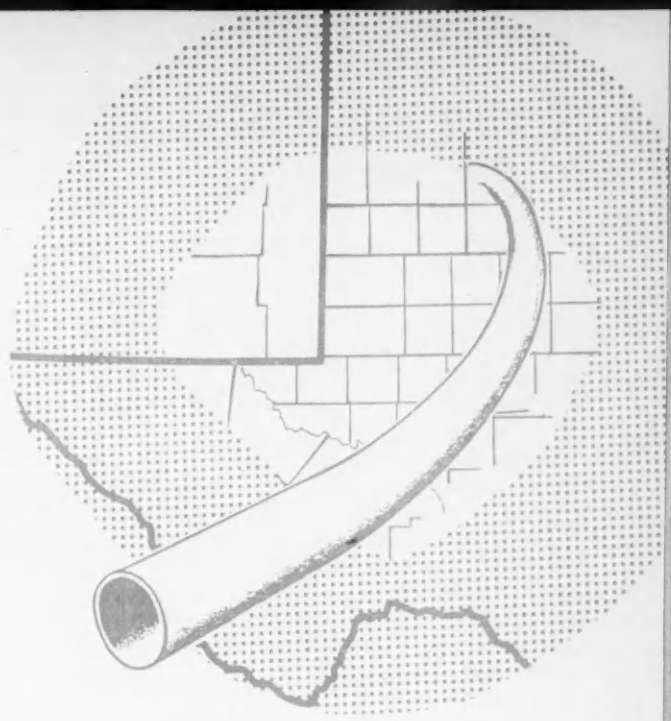
Permian Basin Pipe Lines Transport 1 Million Barrels Daily



By CECIL W. SMITH
Statistical Editor

PIPE line facilities for moving crude from Permian Basin fields now aggregate well over 1 million barrels a day total capacity. That is more than double the volume that could be transported underground in 1944 when total daily capacity of the 11 trunk lines amounted to only 538,000 barrels. But now with 15 trunk lines capable of hauling 1,174,300 barrels of crude a day from this great oil region, it still is not going to be enough and once again the practice of transporting oil by railway tank cars, common during and immediately following World War II, will be necessary.

Only a few years ago the industry thought that by providing slightly more than a-million-barrels-a-day pipe line capacity from the Permian Basin, transportation for the normal increase in the region's production would be amply provided. But the principal difference in that forecast and actuality was the discovery of flush Pennsylvanian reef production in Scurry and surrounding counties.

Most of the older crude pipe lines gained in capacity by increased power or loops since the war, but the principal increase in over-all capacity came with newly constructed systems. The largest was Basin Pipe Line System's 22-inch line that originates at Jal, N. M., and carries Permian Basin oil as far as Cushing, Okla., where it is turned into Ozark Pipe Line System's new line for delivery to Mid-Continent area's refineries. This 22-inch Basin system has a maximum rated daily capacity of

New Mexico Trunk Lines to West Texas

OWNER—	Gathering Line Terminal	Destination	Size	Daily Capacity (Barrels) 1944	Daily Capacity (Barrels) 1950
Atlantic Pipe Line Company	Hobbs	Midland	8	27,000	27,000
Gulf Refining Company	Monument	Wink	8	12,000	12,000
Basin Pipe Line System	Jal	Midland	20	.....	206,000
Humble Pipe Line Company	Hobbs	Wink	8	24,000	31,000
Shell Pipe Line Corporation	Hobbs	Wink	8-10	30,000	40,000
Texas-New Mexico Pipe Line Company	Jal	Crane	10-12	53,000	53,000
Total	.....	.....	....	146,000	342,000

Trunk Lines out of West Texas

Atlantic Pipe Line Company	Midland	Atreco	10	41,000	48,000
Atlantic Pipe Line Company	Crane	Refugio	10	.....	30,000
Basin Pipe Line System	Midland	Cushing, Okla.	22	.....	250,000
Gulf Refining Company	Midland	Ranger	(3)10	75,000	126,000
Humble Pipe Line Company	Kemper	Ingleside	10-12	65,000	75,800
Humble Pipe Line Company	Kemper	Webster	(2) 8	50,000	50,000
Humble Pipe Line Company	Kemper	Satsuma	18	.....	82,300
Magnolia Pipe Line Company	Midland	Beaumont	8	21,000	22,500
Magnolia Pipe Line Company	Midland	Corsicana	12	56,000	94,000
Pasotex Pipe Line Company	Wink	El Paso	8	18,000	28,000
Phillips Petroleum Company	Goldsmith	Borger	12	.....	70,000
Shell Pipe Line Corporation	McCamey	Cushing, Okla.	10	46,000	39,700
Shell Pipe Line Corporation	McCamey	Houston	10	36,000	36,000
Service Pipe Line Company	Sundown	Drumright, Okla.	16	65,000	156,000
Texas-New Mexico Pipe Line Company	Crane	Houston	12	65,000	66,000
Total	.....	.....	.....	538,000	1,174,300

PERMIAN BASIN REFINERIES

OWNER—	PLANT SITE	Daily Capacity, (Barrels)
Southeastern New Mexico		
Continental Oil Company	Artesia	3,000
Malco Refineries, Inc.	Roswell	2,500
McNutt Oil & Refining Company	Brickland	2,500
New Mexico Asphalt & Refining Company	Artesia	4,000
Warren Petroleum Corporation	Monument	600
Total	.....	12,600
West Texas		
Col-Tex Refining Company	Colorado City	12,000
Cosden Petroleum Corporation	Big Spring	18,000
Gulf Refining Company	Sweetwater	10,000
Motor Fuels Corporation	Levelland	5,000
Patton Oil Company	Rotan	1,500
R. J. Reischman Refining Company	Ft. Stockton	100
Western Refining Company	Baldridge Switch	1,000
Wickett Refining Company	Wickett	4,000
Total	.....	51,600

250,000 barrels and is currently operating at about 92 percent of capacity. Plans now call for construction of additional pump stations that would hike daily capacity of this line to 340,000 a day, a gain of 90,000 barrels.

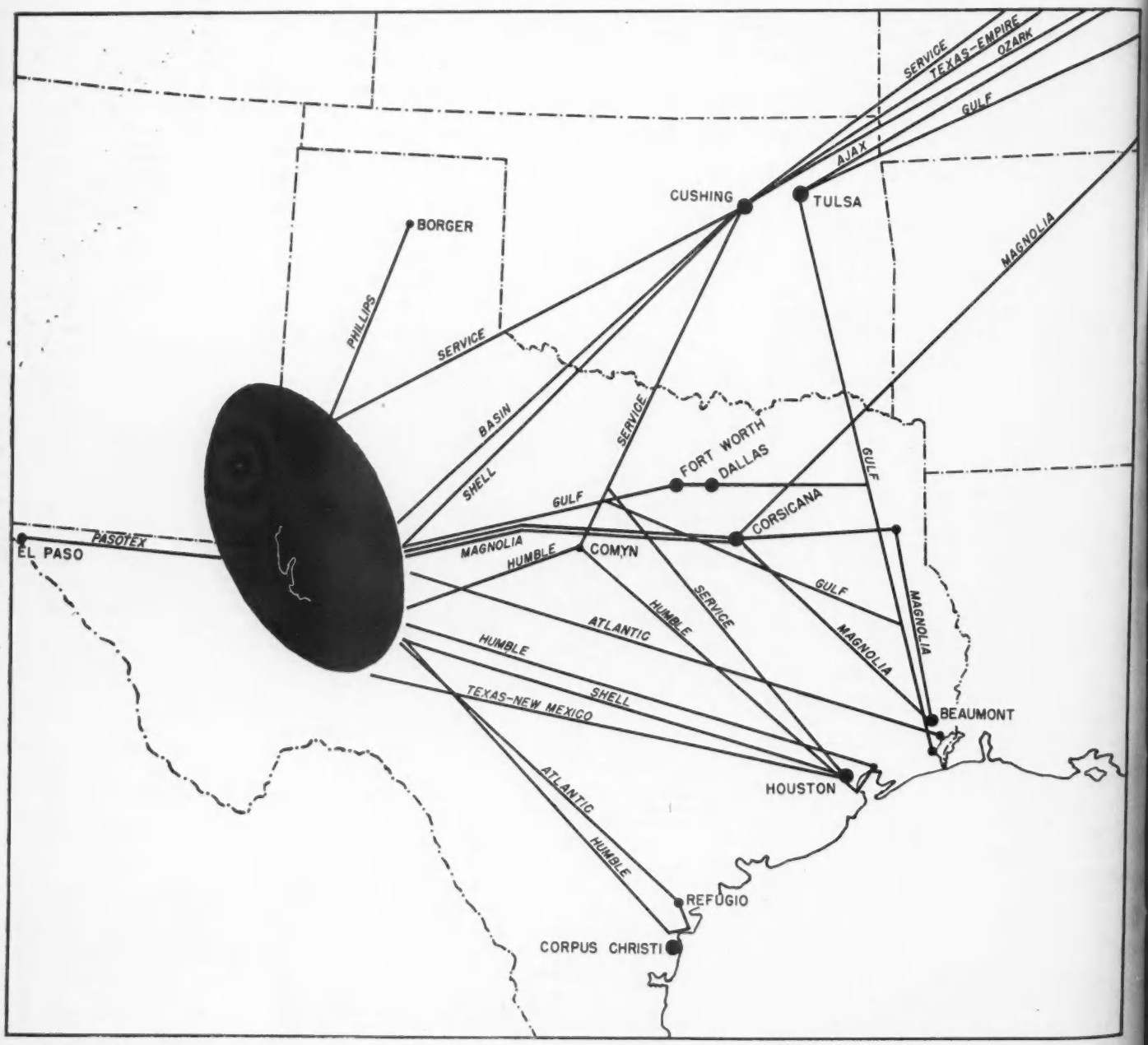
Another newcomer to the West Texas pipe line network is a recently completed 18-inch line laid to Satsuma, near Houston, by Humble Pipe Line Company. Initial daily capacity of this new carrier was 82,300 barrels, but additional pump stations now under construction will boost throughput to 135,000 barrels a day. This line will serve Humble's Baytown refinery. Humble's original line from West Texas takes a longer, more northern route and has been shut down since completion of the new line, and that reduces the capacity out of the Permian Basin by 50,000 barrels unless it again becomes operative.

Last year Atlantic Pipe Line Company completed its second line from West Texas to the Gulf Coast. The latest is a 30,000 barrel 10-inch line to Atlantic's marine terminal in the Corpus Christi area. The older line runs to the company's refinery near Beaumont and is rated at 48,000 barrels a day.

The other crude line built since the war is Phillips Petroleum Company's 12-inch line that originates in the Goldsmith field of Ector County and terminates at that company's refinery near Borger, in the Texas Panhandle. This line is rated at 70,000 barrels a day, but it is not operating at that rate at present. However, Phillips is now planning a connecting line to fill the gap between this new line at Borger and another of its lines that serves its refineries at Kansas City and Okmulgee, Okla. Such a project would increase the need for West Texas crude.

The only oil that moves westward out of the Permian Basin is carried to El Paso for refining by The Texas Company and Standard Oil Company of Texas. This 8-inch line is capable of moving 28,000 barrels daily, and is owned by Pasotex Pipe Line Company.

At present, pipe line capacity to the Gulf Coast from West Texas amounts to about 487,000 barrels, and capacity of 500,000 barrels a day is available to Midwestern and Mid-Continent refineries.



Crude Trunk Lines Serving the Permian Basin

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FIGURE 1. Manifold system, shown here with incoming crude lines at left and center, has provision for later adding to the existing 9 underground legs, locations of which are indicated by motor-operated valves at right.

MONITORING PANEL and AUTOMATIC CONTROLS Improve Tank Farm Efficiency

By GILBERT M. WILSON,
Pacific Coast District Editor

AN OUTDOOR panel which serves as both a control and monitoring board, electrically actuated valves, and a flexible piping manifold system have greatly simplified the operation and at the same time increased the throughput capacity of Shell Pipe Line Corporation's Hendrick tank farm, near Wink, in Winkler County, Texas.

Put in service a little over a year ago and including some of the latest advancements in automatic controls, the setup was designed and installed by company engineers and construction crews. In the process of simplifying and speeding up the handling of crude shipments that come through the tank farm, this streamlined control system has reduced the amount of work required of operating personnel and has minimized the chances for errors in the handling and control of shipments. The tank farm is one of three focal points of Shell Pipe Line's operations in West Texas.

Crude enters the farm from several pipe lines, including a 10-inch line from Wheeler station 20 miles to the east, a 10-inch line from Hobbs, N. Mex., and other smaller lines from fields in the vicinity of the station. In addition, crude may be received from the Basin-Ozark System's 20-inch main line from Jal, N. Mex., this line running through the south portion of the Shell farm. The Basin-Ozark System's Wink station pumping plant, second in a series of stations on the Jal to Wood River, Ill., pipe line, is a short distance south of the Shell farm.

The Shell tank farm currently is handling crude at a rate of approximately 36,000 barrels daily. Both sour and sweet crudes are handled, with gravity of the shipments varying from 26 to 45 degrees API. Viscosity ranges from 150 to 40 Saybolt Universal seconds.

The farm has 3 122,600-barrel and 10 80,000-barrel floating roof tanks. A single 24-inch line, serving as both filling and suction line, connects each of the tanks with the centralized manifold. This is one of the more advanced features and will be discussed in more detail later. Main valves of all but 2 of the 80,000-barrel tanks are in the manifold and are electrically controlled by switches on the large outdoor control panel. Standing at this panel, one man can switch incoming crude into any tank, withdraw stored oil from any tank and dispatch it into the Basin System, or receive Basin System oil and direct it through the manifold and on into the tank farm. Except for the headers and header valves, all manifolding piping is buried to a minimum depth of 3 feet.

In Figure 1 can be seen the above-ground portion of the manifold. At extreme left is an 8-inch line from an adjoining Humble tank farm. Beside it is the Shell 10-inch line from Wheeler station. In the foreground is the 8-inch header of the incoming Shell 10-inch line from Hobbs, and the 20-inch line from the Basin System. At the extreme right may be seen the upper portions of the motor-operated header valves in the 24-inch combination filling and suction lines connecting 9 of the tanks with the main header to which are connected the 2 centrifugal booster pumps.

The booster pumps, Figure 2, are of the vertical-shaft, deep-well type, and are intended to supplement the gravity flow of crude oil en route from the tank farm to the Basin System station. Each pump has a capacity of about 167,000 barrels daily. Each is driven at 1160 revolutions per minute by a 125-horsepower electric motor and delivers against 30 pounds per square inch discharge pressure. Mercury switch protection is provided at the booster-pump transformers. If unexpected low suction or high discharge pressures should occur, electric power to the pump is cut off automatically.

The control panel, Figure 3, which actually is a schematic re-

SIMPLIFICATION of operational details and increased throughput capacity result from the design and installation of monitoring panels and automatic controls on a tank farm currently handling approximately 36,000 barrels per day. Adequate provision for additional facilities will enable the layout to keep abreast of crude handling requirements without making employe supervision burdensome.

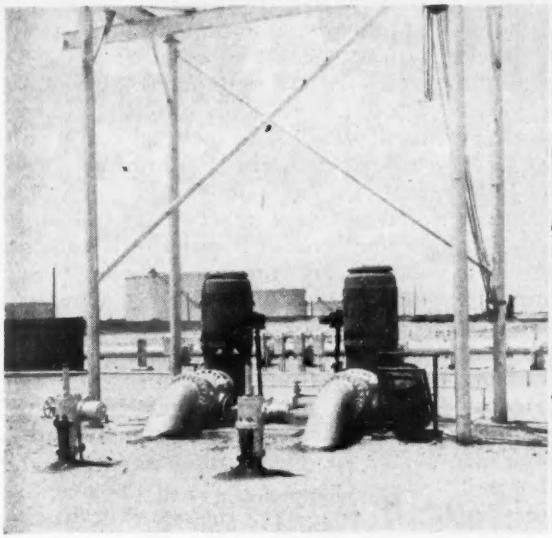


FIGURE 2. Booster pumps, of the vertical shaft, deep well type, supplement the gravity flow of crude oil. Each pump has a rated capacity of approximately 167,000 barrels per day against a 30 psi pressure.

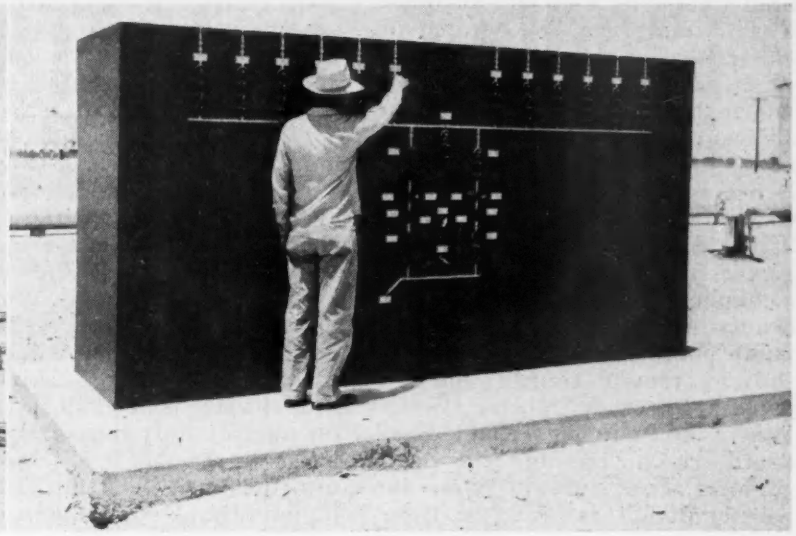


FIGURE 3. A diagrammatic replica of the manifold system is reproduced on this control panel, which provides a quick method of starting and stopping pumps, opening and closing valves, and, in addition, a means of monitoring the receiving and dispatching of crude through the system.

plica of the manifold portion of the station, serves the dual purpose of providing a quick, simplified means of starting and stopping pumps and opening or closing gate valves, and a means of monitoring the dispatching of crude through the farm. This monitoring is made possible by amber, green and red lights on the panel which indicate what is going on at any particular time. Through a blocking arrangement in the electrical circuits, the operator is prevented from opening certain filling-line valves electrically, when the combination suction-filling line is in suction service. This eliminates the possibility of sending crude through the wrong header leg or mixing it with another batch.

The schematic outline on the control panel takes in that part of the farm piping from the buried 24-inch pipe legs (shown coming down from the top of the board), through the main underground header, or into the 2 parallel booster pump suction lines and over to the point where the tie-ins are made with the Basin System line. The lines themselves are represented by a number of ½-inch wide strips of aluminum bar. Valves are indicated by the customary symbol used in layout drawings. Below or beside each valve, in the row of controls above the main header (near man's hand in Figure 3), is a small rectangular aluminum plate on which is stamped the identifying tank number. This corresponds to a similar number on the above-ground portion of the valve on that particular line. Below this identification plate is the on-off switch for that valve, and below that is a bank of 3 lights, amber, green and red.

Lighting of the amber light signifies that the fill line of that particular leg is open and that oil from an incoming line is going into that tank. The green light indicates that the 24-inch header valve at the lower end of the buried leg is closed, and crude oil cannot be shipped mistakenly into the Basin System line. The red light comes on when this header valve is open. If blending of 2 or more outgoing crudes is desired, the header gate valves of the respective legs are left open, allowing crudes to mix en route to the Basin System line.

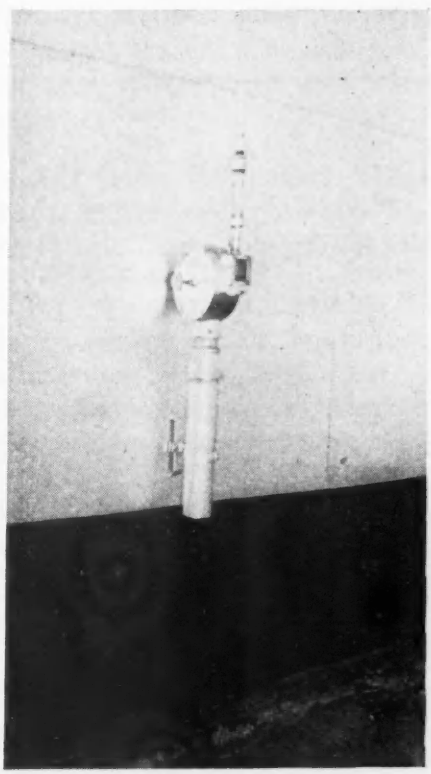


FIGURE 4. Remote-reading, ground level gauging systems were installed on most of the tanks in the farm. Hourly gauges now are taken in but a fraction of the time required with tape gauges.

In the center of the horizontal header line on the board, at the junction of the header and the 2 parallel main lines extending over to the booster pumps, are switches and colored lights representing and controlling (1) the electric motor-operated main valve dividing the east and west halves of the header and (2) the motor-operated valve on each of the 2 booster-pump suction lines. On the control board, a switch is provided for each of these valves and the corresponding valve number is stamped on an aluminum plate beside it. Two lights also are provided for each valve, a green light indicating that the valve is closed and a red light indicating that it is open.

The electrical circuits on the board are designed so that an operator cannot mistakenly open one of the two booster pump suction valves while an amber light shows on one of the header valves, i.e., while crude is going into a tank. These motorized valves always can be operated by hand, however, if necessary.

Local or Remote Pump Controls

Booster-pump controls include a starting switch and a pair of col-

ored lights for each of the units. The switches can be operated on either local or remote control, this feature providing a means by which the engineer on duty at the adjacent Basin System station can start or stop the booster pumps, if necessary, without first having to contact the employe on duty at the Shell farm. The Basin engineer, having on his control board a duplicate replica of the Shell header system, from the booster pump point on down, can control, through remote control, the dispatching of crude into his system. When the switches on the Shell board are on "remote," the Basin engineer can start or stop the booster pumps as he wishes from his own control board. In case of an emergency, however, the Shell operator can operate them through his local control switch. An amber light beside each of the pump controls indicates to the man on duty that current is at hand but that the motor is not on. When the motor is turned on, the red indicator light lights up.

The booster pumps discharge into the Basin System's 20-inch receiving line. Going through a check valve downstream from the pump, the crude flows through another pair of motor-operated valves. On the control board, these last valves are indicated by their corresponding valve control switches and identification plates. Each has a pair of lights, one green and one red. When a green light is on, it indicates that the valve is closed. If the red light is on, it indicates that the valve is open.

In addition to the indicator light system as used on the control panel, each valve on the incoming and outgoing lines in the manifold has its own pair of indicating lights, red and green. If the red light on a particular valve is on, it indicates that a 24-inch leg header valve is open and warns the operator on duty that oil is moving through the booster pumps and into the Basin System. The green light indicates that the main line valve is closed.

Earlier, it was pointed out that each tank in the farm is served with a single 24-inch combination suction and filling line. At present, there are 9 such lines connected directly into the corresponding 24-inch buried legs of the header system. Additional lines and header legs can be installed in the future whenever desired. The primary objective of the single line system is to eliminate the possibility of an operator's making an error in filling or shipping-out of the tanks. Since a tank at any one time can be doing only one of two things—either filling or emptying—the chances of making an error are practically eliminated, and, as a consequence, gauging and dispatching of shipments are more accurately and efficiently performed. The 24-inch legs are laid to grade with a minimum of 3 feet of earth coverage, and are spaced 6 feet apart.

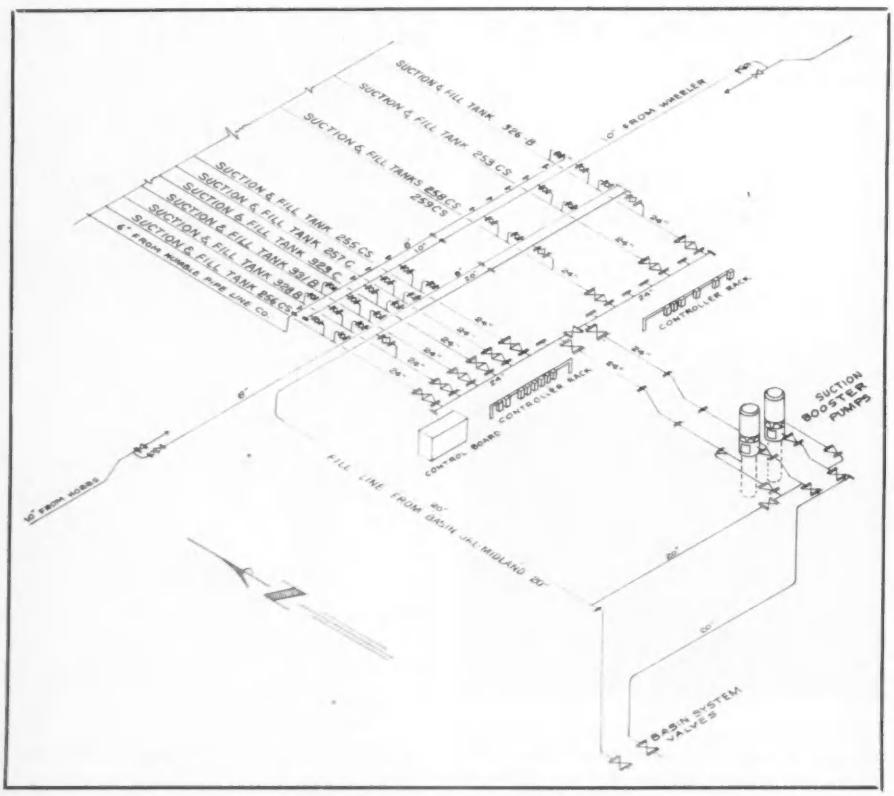
The motor-equipped header valves are operated through oil-immersed explosion-proof switches. These switches are arranged in banks in a row paralleling and directly in front of the corresponding bank of header valves.

Included in the extensive program of overhauling and modernizing existing parts of the original tank farm facilities was the installation of ground-level indicating tank guages on most tanks in the farm. Shown in Figure 4, this type instrument enables the guager to make his hourly gauges in but a fraction of the time formerly required for him to climb to the top of the large tanks and gauge with the conventional tape. Well-kept roadways and walkways, easily accessible gates and recording instruments, together with modern floodlighting at critical points on the farm, combine to provide even greater efficiency in the operation of the tank farm and pumping station.

Savings Realized

Important savings are being realized by the company as a direct result of the installation of these improved tank farm and shipping facilities. Perhaps the most important of these is the fact that station personnel now can handle a greater volume of crude with less effort, yet at a lesser risk of making errors in receiving and shipping. The arrangement is flexible and can be added to at any time, the original plans, in fact, making provision for a total of 14 legs ultimately to be installed in the manifold. By using a common fill and suction line, tanks are more accurately and efficiently gauged. Since all tank valves are grouped in a single, compactly-arranged manifold area, the operator need not spend a large proportion of his time traveling to and from the tank farm to open and close tank valves.

The control panel simplifies the handling of valves, and since it is a visual replica of the actual piping, showing every valve and line in the header, time required to learn the workings of the system is greatly reduced.


SUCTION & FILL TANK 326-B
SUCTION & FILL TANK 253-CS
SUCTION & FILL TANKS 255-CS 259-CS
SUCTION & FILL TANK 255-CS
SUCTION & FILL TANK 257-C
SUCTION & FILL TANK 325-C
SUCTION & FILL TANK 331-B
SUCTION & FILL TANK 328-B
SUCTION & FILL TANK 254-CS
6" FROM MIDDLE PIPE LINE CO.
12" FROM WEBER
12" FROM HOBBS
FILL LINE FROM BASIN JAL MIDLAND
CONTROLLER RACK
CONTROLLER RACK
CONTROL BOARD
SUCTION BOOSTER PUMPS
BASIN SYSTEM VALVES

Schematic layout of the manifold system.

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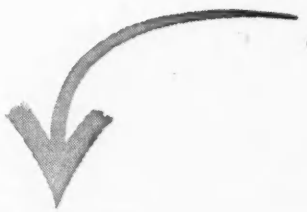

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New Short Line

Speeds West Texas Crude

By ELTON STERRETT,
Engineering Editor

SHORTENING its previous linkage of relatively small multiple diameter pipe lines between West Texas gathering points and the refining center at Baytown, Humble Pipe Line Company's new 18-inch carrier from Kemper, Reagan County, Texas, to Satsuma, Harris County, cuts 52 miles off the distance and materially augments deliveries from the Permian Basin area.

The 370-mile line is laid as directly as possible across Texas between the Kemper station and Satsuma, tying in at the latter point with a previously constructed 20-inch trunk to Baytown. Only the Kemper station was completed and in operation August 1, but 3 other stations, scheduled for operation before the end of the year, will step up deliveries to the design maximum.

On the western end the 40-foot mill lengths of pipe were welded into field "doubles" insofar as terrain permitted, with special equipment set up at Barnhart and Eldorado, using the shielded arc method with alignment devices which reduced manual work to a minimum. The 80-foot doubles were trucked out on the line, pipe wall being heavy enough so that no special equipment was required to unload or spot the pipe along the right-of-way. Field welds were X-rayed after completion, using a device which could be run inside the pipe or clamped to the outer wall. When clamped outside the weld, a strip of film sufficient to wrap half the joint was used, and the weldment X-rayed through the nearer pipe wall. By rotating the equipment around the weld strip film was exposed which, when joined, gave a complete weld picture.

The line offered unusual difficulties in ditching and river crossings. Much of the trench was through rock which required drilling and shooting. Shot holes were drilled with 4- and 6-gang drills on special frames, so adjusted as to give the proper spacing between holes. These multiple sets were powered by a pair of compressors, each delivering air to the drill manifold. By gang-drilling the holes in this manner, considerable time and manpower were saved over the method of drilling single holes with a man to each pneumatic drill.

River Crossings

The line crossed rivers such as the Pedernales and Llano, in the flash flood area, where the water can change from a placid stream to a boulder-moving torrent in a few minutes, and special care was given to the placing of the pipe in a ditch deep enough to insure it against flood damage. Trenches were cut across these streams as elsewhere in the solid rock, using the gang drills. Frequently these units were operated in water reaching close up on the engines of the compressor and crawler tractor units.

Due to the detritus carried by these streams even when low enough to permit drilling the shot holes, it was necessary for the crew placing the explosives to follow closely behind the drills. The blasting circuits for the shots, for the same reason, could not be laid along the river bed, but had to be supported on a series of sticks which gave the setup the appearance of a trot-line fisherman's paradise. Back-hoes and bulldozers were used for clearing the ditch after shooting.

To protect the river crossings against corrosion, they were given a 2-inch coating of reinforced concrete after being cleaned, primed, coated and wrapped in the conventional manner. Across the Pedernales, as further safeguard against flood damage, the line was concreted in the trench after being lowered. The top of the filled trench then in effect became again an unobstructed and undisturbed portion of the river bed, offering no target for rolling boulders.

Pump Stations

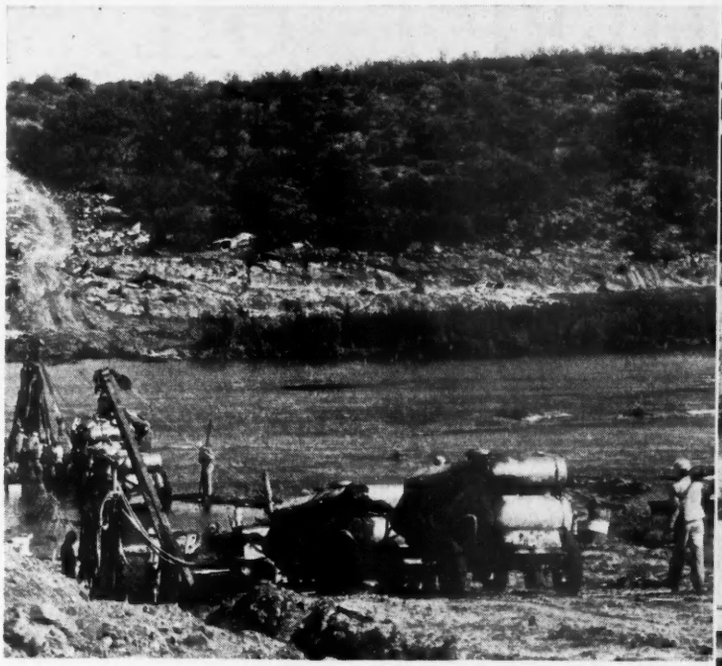
The station at Kemper is equipped with permanent pump installations requiring 3300 horsepower, to which are added some 600 horsepower in the portable equipment. Both permanent and portable units are being used for the long "push" to the Satsuma delivery point.

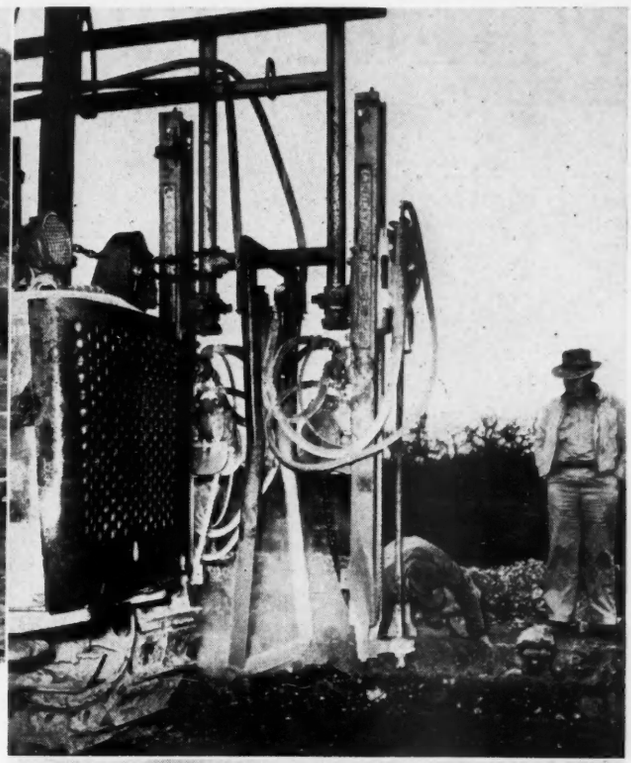
The 3 intermediate stations will be near Fort McKavett, Eckert, and Warda. In each of these there will be 2 1000 horsepower electric motor driven centrifugal pumps as initial installation, with an additional 500-horsepower pump unit being added to bring the line throughput up to the eventual design figure of 135,000 barrels per day. Stations will be of the push-button, semi-automatic type with control room separate from the area occupied by the pumps. Other than a divided stream at Kemper, which also pumps to Corpus Christi, all crude received will be forwarded intact as batched from origin to the Satsuma tie-in.

Short-wave radio telephones were used in dispatching materials and all communications between the 3 spreads and supervisory personnel during the laying of the line. With the right-of-way traversing terrain far from other and established communication means, much time was saved.

A microwave communications system links the Kemper station with the receiving end of the line at Satsuma. As the 3 intermediate stations are completed and placed on the line they, too, will be tied into the microwave system and will utilize this weatherproof communication method for all dispatching, trouble-shooting and other line messages. A series of repeater stations, fully automatic and so located as to be in constant contact with adjacent units, picks up and relays messages until the destination is reached. Danger of disruption of operations, such as recently incurred during a severe ice storm, is thus avoided and maintenance of the usual pole and two-wire circuit is eliminated.

The new line, with all stations in service, will afford a tide water outlet for 135,000 barrels of West Texas crude per day, and will to that extent aid in moving crude from the rapidly developing Permian Basin area.





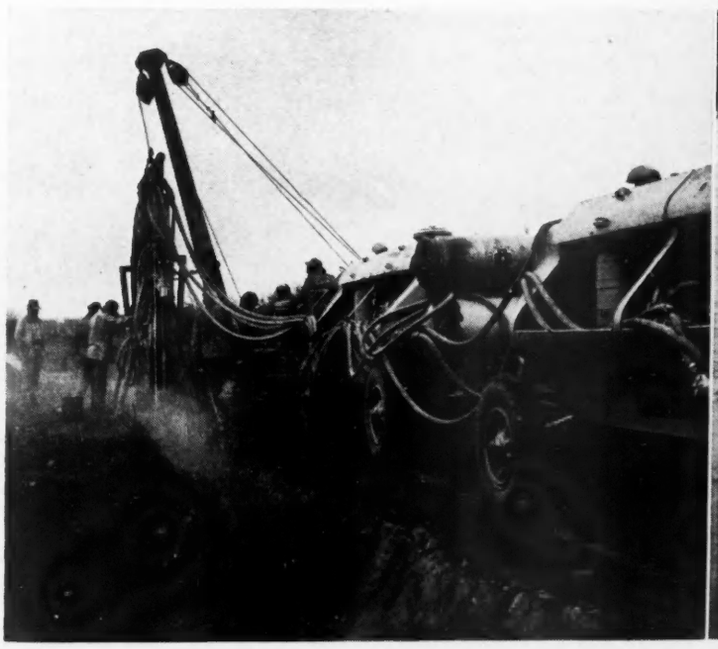
UPPER LEFT. The gang-drill caravan moves down to the river bank to begin drilling for the trench to be blasted from the solid rock of the river bed.

UPPER RIGHT. Close-up of one of the gang drills, with separate mountings for each drilling unit to permit speed in servicing.

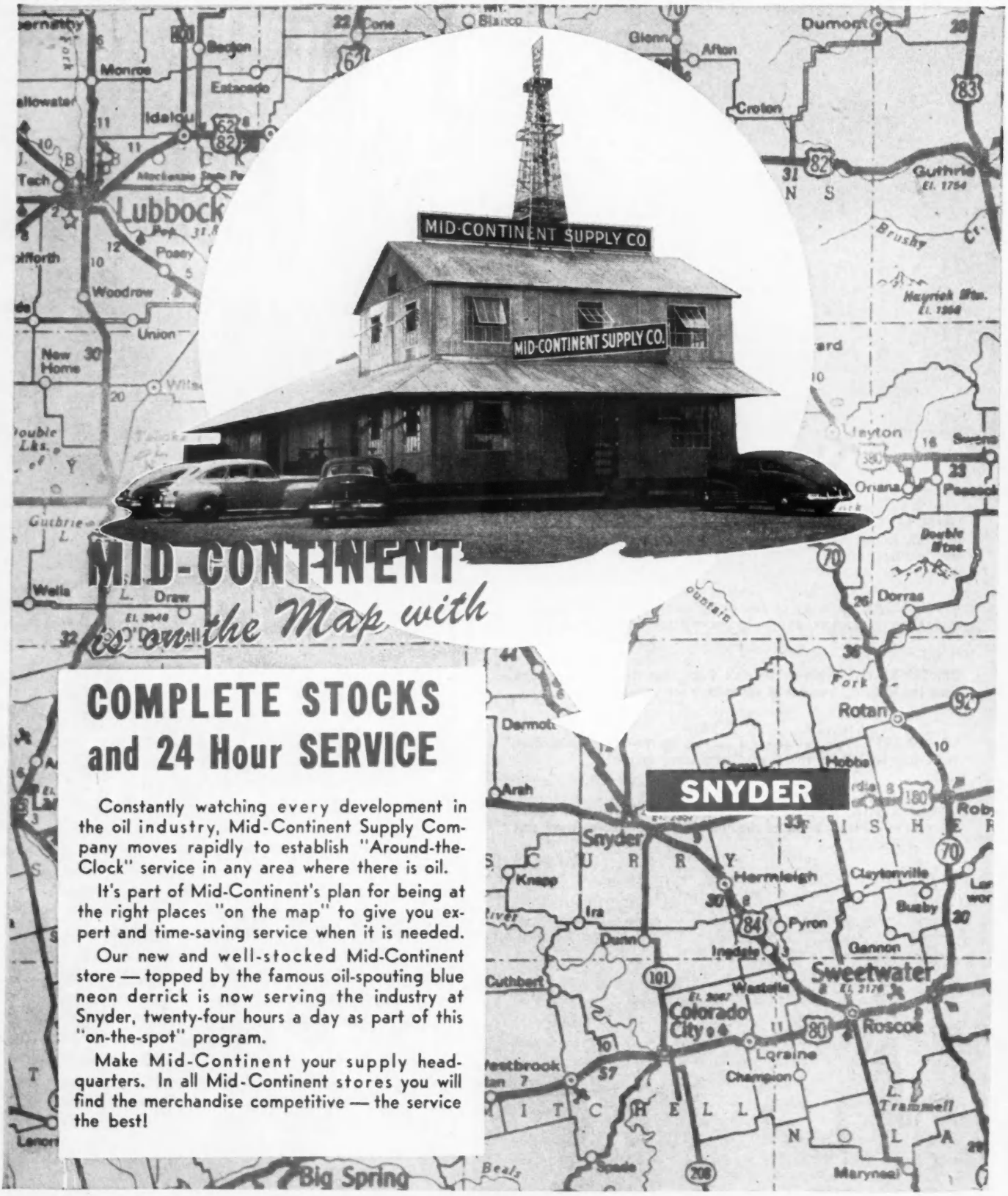
CENTER RIGHT. Not a fisherman's dream, but the method used to keep the blasting line out of the swift river current.

LOWER LEFT. Two compressors provide air for each gang drill. Individual hoses from the storage tank serve each unit.

LOWER RIGHT. Working in the swift current immediately behind the drill to prevent closing of the hole with stream-borne trash cost many a ducking.



WHEREVER THERE IS OIL!!!



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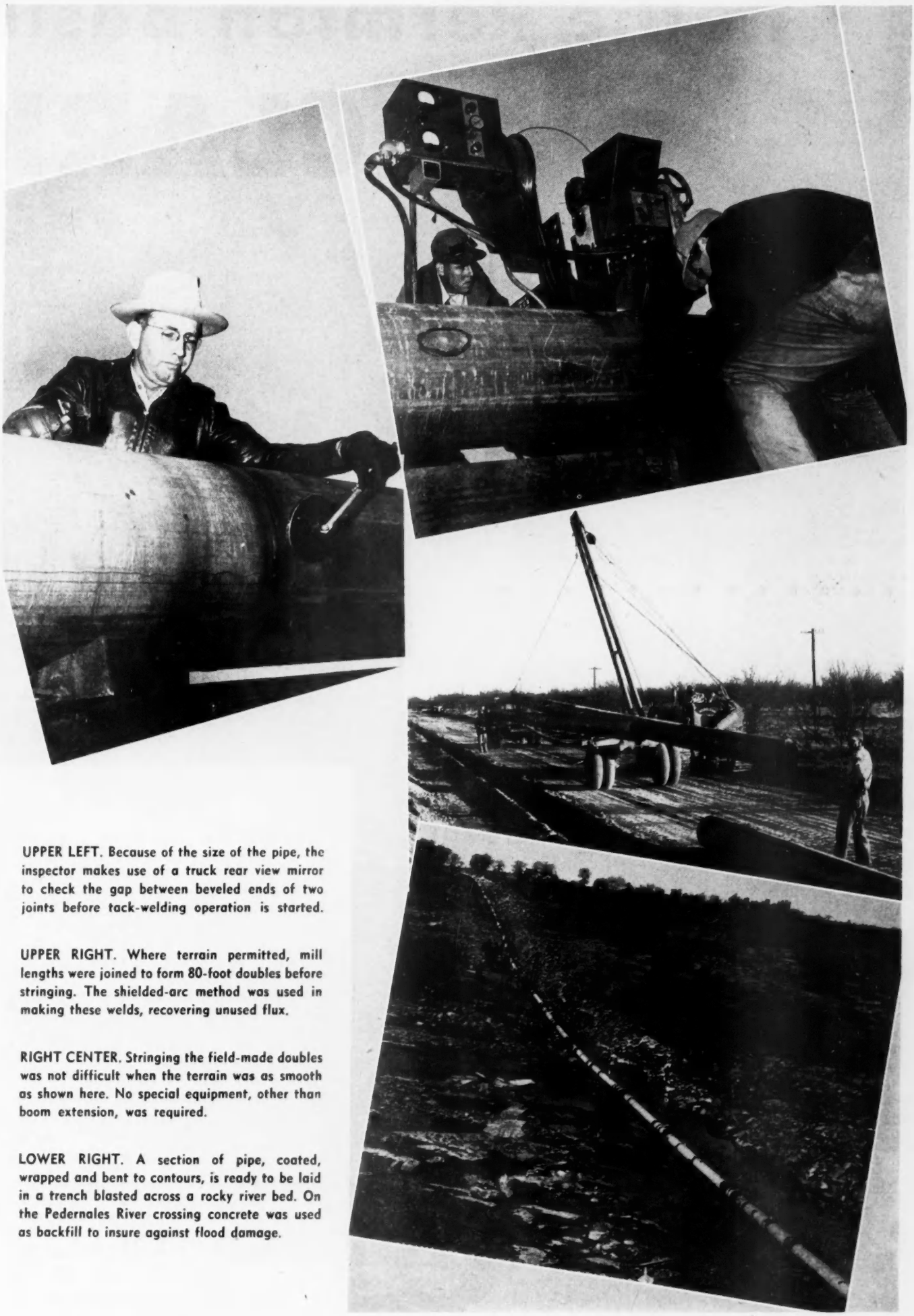


UPPER LEFT. Because of the size of the pipe, the inspector makes use of a truck rear view mirror to check the gap between beveled ends of two joints before tack-welding operation is started.

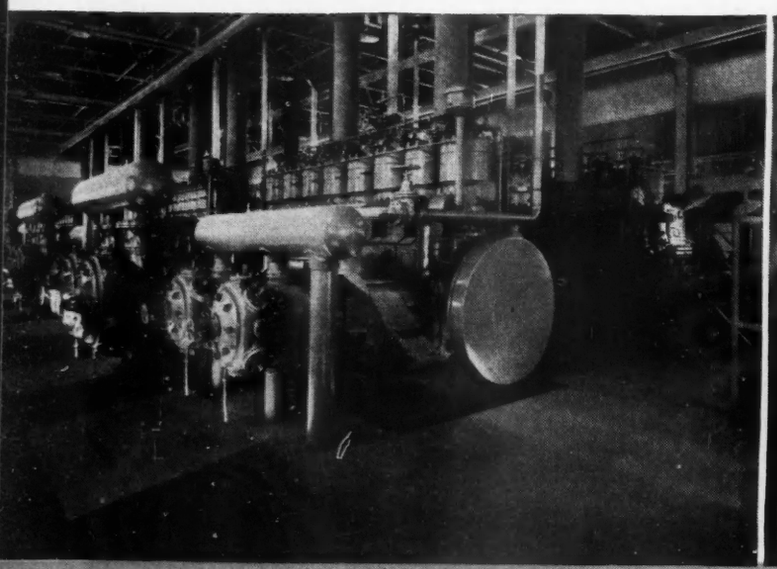
UPPER RIGHT. Where terrain permitted, mill lengths were joined to form 80-foot doubles before stringing. The shielded-arc method was used in making these welds, recovering unused flux.

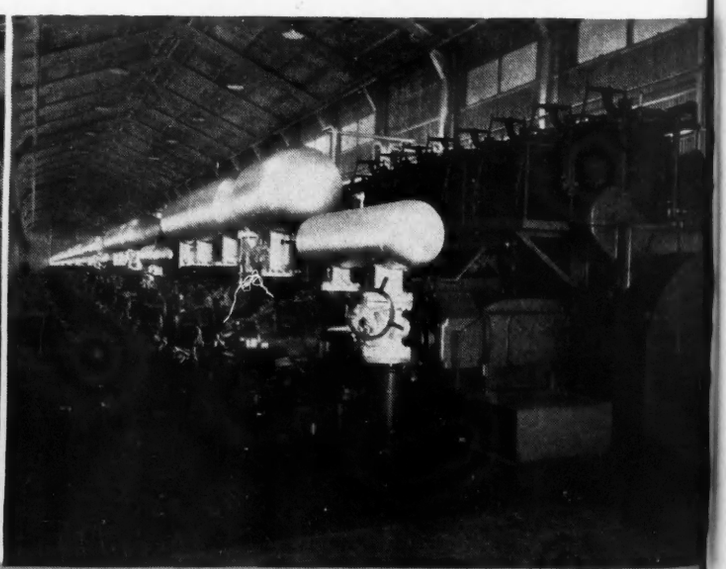
RIGHT CENTER. Stringing the field-made doubles was not difficult when the terrain was as smooth as shown here. No special equipment, other than boom extension, was required.

LOWER RIGHT. A section of pipe, coated, wrapped and bent to contours, is ready to be laid in a trench blasted across a rocky river bed. On the Pedernales River crossing concrete was used as backfill to insure against flood damage.

In the Permian Basin

CLARK





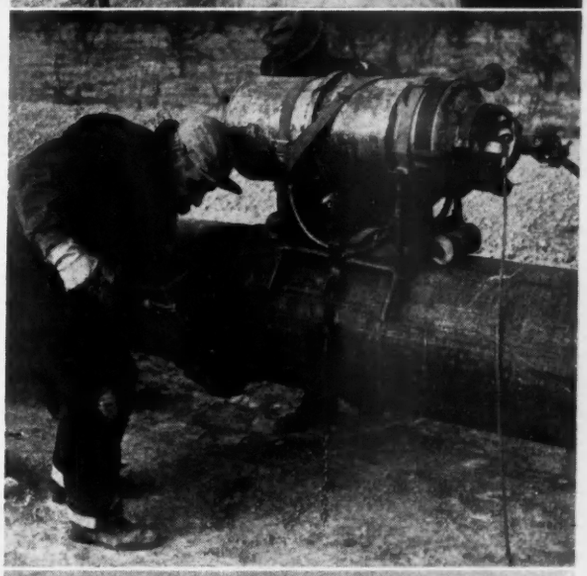
Wasson No. 2—part of Clark RA-8 installation totalling 19,200 BHP at Shell Oil Company's Wasson No. 2 plant.

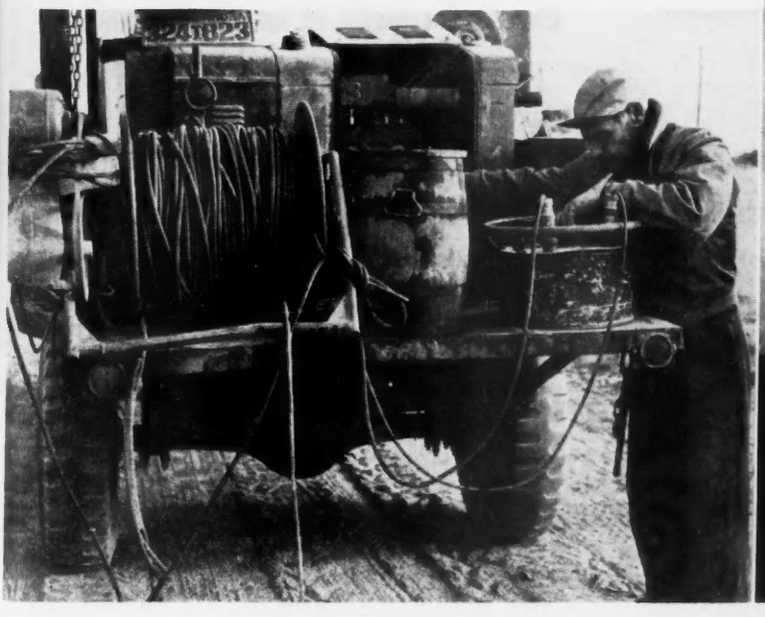
Slaughter Gasoline Plant—operated by Stanolind Oil and Gas Company.

SEE THE DIFFERENCE IN

CLARK

ONE OF THE DRESSER INDUSTRIES





UPPER LEFT. Placing the X-ray unit atop a weld for examination of lower portion of the joint. Curved rollers simplify exact spotting of the active X-ray head.

UPPER RIGHT. With the X-ray unit clamped for examining an upper third of the weld, the film is carefully spotted over the weld beneath its sheet lead backing strip.

CENTER RIGHT. A noose and soft line permit quick placing of the sensitized film around the portion of the weld diametrically opposite the X-ray head.

LOWER LEFT. On the X-ray truck the operator checks the rheostat which controls the current to the X-ray tube. The truck is always spotted far enough from weld to avoid dangerous exposure to operator.

LOWER RIGHT. Hanging the film to dry after quick development in the special case carried on the service truck gives prompt record of weld condition.

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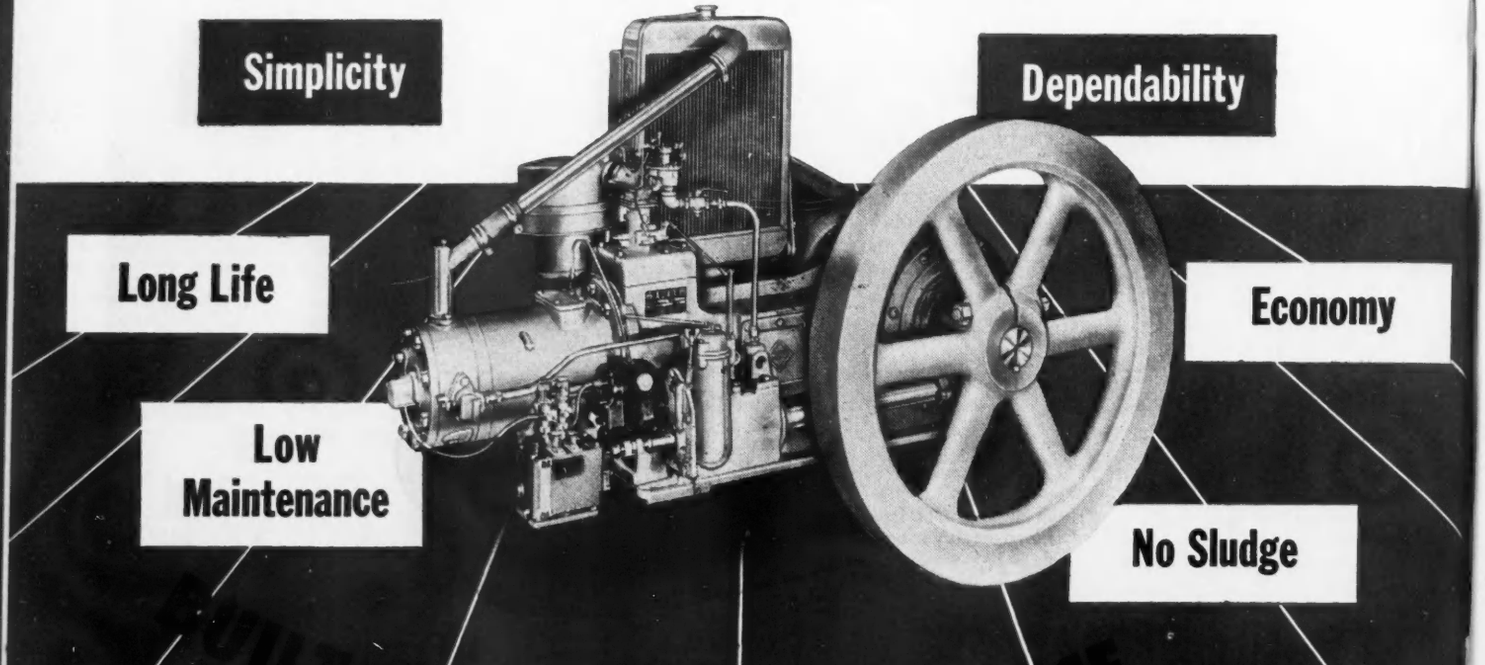

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PIPE LINE *Construction*

By SYLVIA LILLIE
Staff Writer

Projects Announced and Contracts Awarded

Products Lines

Essaness Corporation (Sohio Petroleum Company and Shell Oil Company) plans a 57-mile, 8-inch line from Springfield to Lima, Ohio. It will acquire Shell's Springfield-Columbus line and Sohio's Springfield-Dayton and Lima-Toledo lines.

Miami Valley Corporation (Sohio and The Pure Oil Company) plans a 58-mile, 8-inch line from Cincinnati to Dayton. A pump station will be built at Dayton and operated by Sohio.

Natural Gas Lines

Bluefield Gas Company has applied to FPC for permission to build 14 miles of 6-inch from Amere Gas Utilities Company's line at Princeton, W. Va., to Bluefield, Va.

Colorado Interstate Gas Company has FPC authorization to lay a 215-mile, 20-inch line from the West Panhandle field to its Lakin-Denver line at Kit Carson, Colo. A 4800-horsepower compressor station will be built at the southern end.

Crossett Lumber Company has asked permission to construct a 30-mile 8-inch line to bring gas to its plant at Crossett from Arkansas-Louisiana Gas Company's line in Union County, Ark. Arkansas Louisiana will operate the line.

Cumberland and Allegheny Gas Company has applied for authority to build 10 miles of 6- and 8-inch line and a 65-h.p. compressor station in West Virginia.

Manufacturers Light & Heat Company applied to FPC for the building of 44 miles of 4- to 16-inch at various points on its system in Ohio, Pennsylvania, and West Virginia.

MidSouth Gas Company asked FPC for authorization to build 240 miles of pipe to carry gas to 21 communities in northwest Arkansas. The system would be supplied at the northern end by Mississippi River Fuel Corporation's line at Biggers, and at the southern from a connection with Texas Gas Transmission at Helena, Ark. Plans include the acquisition from Arkansas Power & Light Company of 26 miles of main line plus distribution systems in 20 towns in eastern Arkansas.

Mississippi River Fuel Corporation has approval to build 40 miles of 20-inch between Dubach and Perryville station, Louisiana.

Michigan-Wisconsin Pipe Line Company has been authorized to raise its capacity to 110,595 Mmcf by the addition of 109,600 hp at 14 points along its line.

North Central Gas Company asked FPC permission to build 24 miles of 8-inch and 11 miles of 6-inch out of Huntsman field, Neb., and 13 miles of 6-inch from Northport to Bayard, Neb.

Ohio Fuel Gas Company has been authorized to lay a 22-mile, 16-inch line in the vicinity of Dayton.

Tennessee Natural Gas Lines, Inc., has authorization to build a 24-mile line to supply Nashville Gas & Heating Company for distribution in the Nashville area.

Texas Gas Transmission Corporation plans to lay 290 miles of line connecting its newly acquired gas fields in southern Louisiana to its transmission line near Monroe, La.

Union Gas Company of Canada, Ltd., is planning 140 miles of line from a storage area in Dawn Township to Hamilton, Ontario. Building is contingent on permission to import increased quantities of Texas gas.

United Gas Pipe Line Company has applied to FPC for authorization to construct 1005 miles of new pipe line including: 451 miles of 30-inch, 6 miles of 26-inch, 53 miles 24-inch from Agua Dulce field, Texas, to the Monroe, La., area; 212 miles of 30-inch, 13 miles of 26-inch, 4 miles of 24-inch, 16 miles of 20-inch from The Pure Oil Company's platform off the Louisiana coast to United Gas Company's Jackson, Miss., station; 215 miles connecting the proposed 30-inch line with various producing areas and extending to Kosciusko, Miss., where it will deliver gas to Texas Eastern; 24 miles of 8-, 12-, and 16-inch connecting various fields in southern Louisiana with the proposed facilities. The building of these lines would initially increase United's capacity by 850 Mmcf.

Projects Starting

Crude Oil Lines

American Petroleum Company will start 11 miles of 8-inch from Sour Lake to Arriola, Texas, in September. Latex Construction Company, Houston, is contractor.

Service Pipe Line Company started in August 24 miles of 8-inch from Beaver Creek field to its line between Pilot Butte and Lost Cabin, Wyo.

Sun Pipe Line Company is building a 16-mile, 6-inch line from Nona Mills, Hardin County, to Saratoga station, Texas. Joe Titsworth, Kilgore, Texas, is contractor.

Products Lines

Dow Chemical Company started in August a 66-mile, 6-inch line from Freeport to Katy, Texas. Barry Construction Company, Houston, is contractor.

Northern Natural Gas Company started in July 63 miles of 4-, 6-, 8-, and 12-inch line in Stevens and Seward counties, Kansas.

Susquehanna Pipe Line Company is building a 125-mile, 8-inch line from Sun Oil Company's refinery at Toledo, Ohio, to Sarnia, Ontario. H. L. Gentry Construction Company, Jackson, Mich., is contractor.

Natural Gas Lines

City of Charlottesville started 14 miles of 6-inch in August to supply the city's distribution system from Virginia Gas Transmission Corporation's proposed metering and regulating station near Doylesville, Va. Lehman, Hoge & Scott, Harlingen, Texas, is contractor.

El Paso Natural Gas Company will start in September 451 miles of 24-inch from the San Juan Basin, N. M., to its proposed 26-inch line near Needles, Calif.

Manufacturers Light & Heat Company is building 40 miles of 8-, 10-, and 20-inch in the vicinity of York, Penn. Britton Contracting Company, Inc., Washington, Penn., started in August.

New York State Natural Gas Corporation started in August 46 miles of 16- and 18-inch in the Renova, Penn., area. Pipeline Construction & Drilling Company, Camp Hill, Penn., is contractor.

Panhandle Eastern Pipe Line Company is laying 16 miles of 26-inch near Decatur, Ill. Anderson Bros. Corporation, Houston, is contractor.

South Jersey Gas Company started work in August on 77 miles of 8-, 10-, 12-, and 16-inch from Transcontinental's lateral near Camden to Atlantic City, N. J., with laterals to Glassboro, Bridgeton, Vineland, and Estelville. G. G. Griffis, Inc., Tulsa, is contractor.

Tennessee Gas Transmission Company will start in September 33 miles of 30-inch from Jones, La., to the Mississippi River. Latex Construction Company, Houston, is contractor.

Projects Completed

Crude Oil Lines

Imperial Pipe Line Company, Ltd., completed in August 6 miles of 4- and 6-inch from the Simmons area to its Redwater gathering system, Alberta. Banister Construction, Ltd., Edmonton, was contractor.

Magnolia Pipe Line Company finished in August 50 miles of 12-inch in 4 loops between Colorado City and Hillsboro, Texas. Bishop & Lock Construction Company, Dallas, is contractor.

Magnolia Pipe Line Company finished in August 22 miles of 8-inch in Howard and Scurry Counties. Shanks & Eustace, Alice, Texas, contractor.

Mid-Valley Pipeline Company has finished 3 spreads of its 22-inch East Texas-Ohio line: Section 1A—69 miles from Longview, Texas, to the Red River near Benton, La., completed in August by O. R. Burden Construction Corporation, Tulsa; Section 3A—111 miles from Mayersville to Oakland, Miss., completed in August by Associated Pipe Line Contractors, Inc., Houston; Sections 3B and 4A—106 miles from Oakland to Henderson, Tenn., finished in July by Houston Contracting Company, Houston.

Pan American Pipe Line Company completed in August 80 miles of 10-inch from southern Scurry County to Humble Pipe Line Company's system at San Angelo, Texas. Brown & Root, Inc., Houston, was contractor.

Pelican Oil Purchasers, Inc. completed in August a 55-mile, 6-inch line in the vicinity of Sulphur, La. Anderson Bros. Corporation, Houston, was contractor.

Natural Gas Lines

Arkansas-Louisiana Gas Company completed in August 72 miles of 20-inch from Waskom field, Texas, to Magnolia, Ark. Anderson Bros. Corporation, Houston, was contractor.

Central Hudson Gas & Electric Corporation laid 40 miles of 10-inch from Home Gas Company's line at Tuxedo to Central Hudson's gas manufacturing plant at Poughkeepsie, N. Y. Britton Contracting Company, Inc., Washington, Penn., finished construction in August.

El Paso Natural Gas Company completed in August 116 miles of 12-inch from Snyder to Goldsmith, Texas.

El Paso Natural Gas Company completed in August a 32-mile, 30-inch line out of Guadalupe station, N. M.

The Montana Power & Light Company built an 83-mile, 12-inch line from Butte to Bozeman, Mont. Deaton & Sons, Inc., Odessa, Texas, finished the work in August.

New York State Natural Gas Corporation completed 26 miles of 16-inch from Colvin station, Washington County, to its Waynesburg, Penn., system. Williams-Austin Company, Pittsburgh, was contractor.

Niagara-Mohawk Power Company completed in August 35 miles of 10- and 14-inch from Therm City to Fulton, N. Y. Williams-Austin Company, was contractor.

Northwestern Utilities Limited built 20 miles of 8-inch between Devon, in Leduc field, and Edmonton, Alberta. It was completed in July by company crews.

Panhandle Eastern Pipe Line Company completed in August 30 miles of 30-inch from Rockville, Ind., to Glenarm, Ill. Anderson Bros. Corporation, Houston, was contractor.

Panhandle Eastern Pipe Line Company completed in August a 30-mile, 26-inch loop between Wauseon, Ohio, and Monroe, Mich. E. J. Mahoney Contracting Company, Mount Pleasant, Mich., was contractor.

Panhandle Eastern Pipe Line Company finished 69 miles of 26-inch in 4 loops between Hugoton and Olpe, Kansas. Midwestern Constructors, Inc., Tulsa, completed in August.

Plains Natural Gas Company completed in August 120 miles of 4- through 16-inch in Hugoton field, Oklahoma. Midwestern Constructors, engineers; Arey-Phillips Construction Company, Pampa, Texas, was contractor.

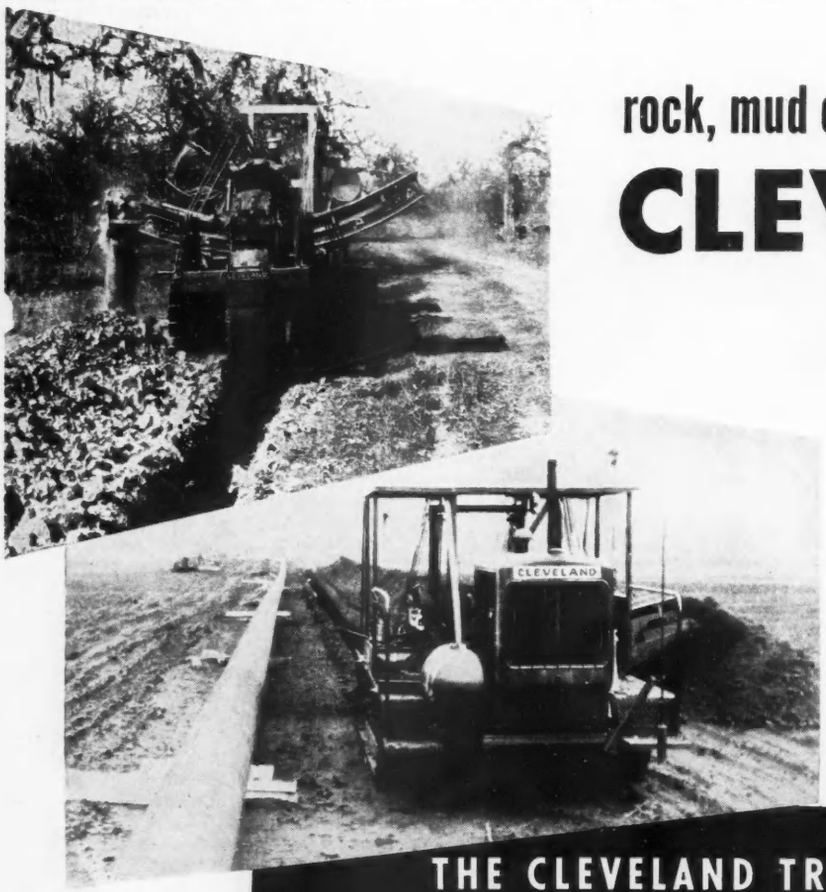
Roanoke Pipe Line Company completed in August 30 miles of 8-inch from Virginia Gas Transmission Corporation's line at Gala to Roanoke, Va. Lehman, Hoge & Scott, Corpus Christi, was contractor.

Tennessee Gas Transmission Company completed in August the following main-line loops and laterals: 101 miles of 30-inch loop from Many to West Monroe, La., completed by Latex Construction Company, Houston; 75 miles of 30-inch loop from the Kentucky-Tennessee line to Campbellsville, Ky., finished by Price-Morrison, Austin; a 54-mile, 12- and 16-inch lateral from Kinder to Grand Chenier, La., built by Latex Construction Company; a 40-mile, 16-inch lateral from New Castle to Pittsburgh, Penn., built by Britton Contracting Company, Inc., Washington, Penn.

Transcontinental Gas Pipe Line Corporation completed in August the following sections of its Texas-New York line: Schedule A—38 miles of 10-inch and 42 miles of 14-inch from Mercedes to Falfurrias, Texas, Massey Pipe Line Construction Company, Inc., Cape Girardeau, Mo.; Section 7—86 miles of 30-inch from Danielsville, Ga., to Spartanburg, S. C., Williams Bros. Corporation, Tulsa; Section 8—102 miles of 30-inch from Spartanburg to the Catawaba River, N. C., R. H. Fulton & Company, Lubbock, Texas; Section 10—86 miles of 30-inch from Chatham, to Scottsville, Va., Smith Contracting Corporation, Fort Worth; Section 12—4 miles of 26-inch and 19 miles of 30-inch from Linden to the Hudson River near Edgewater, N. J., Oklahoma Contracting Company, Inc., Dallas.

Transcontinental Gas Pipe Line Corporation finished in August an 85-mile, 4- to 14-inch gathering system in southern Louisiana. Latex Construction Company, Houston, was contractor.

United Natural Gas Company completed in August 60 miles of 12-inch in the vicinity of Brookville, Penn. Williams Bros. Corporation, Tulsa, was contractor.



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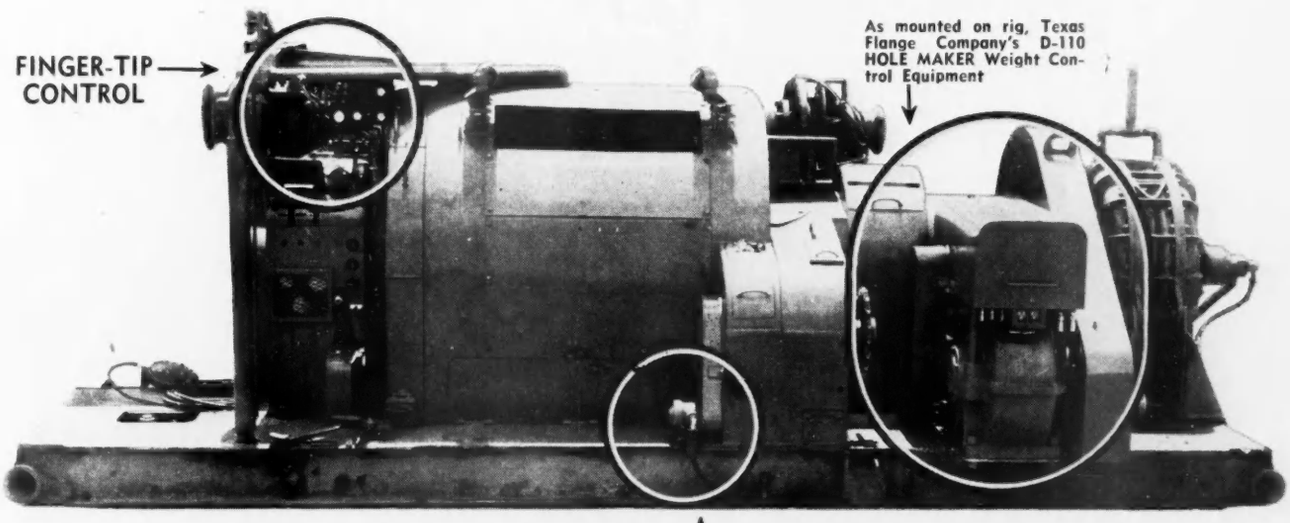

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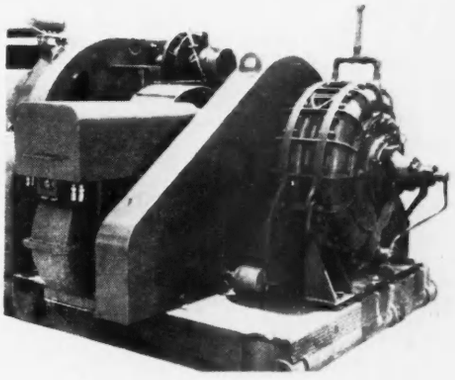

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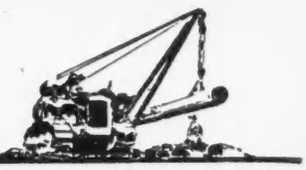
How to do it!

PIPE LINE HINTS



$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

HOW TO—Store Pipe Line Welding Cable on Skid

One contractor equips the welding skids with a short mast. To the top of this mast is pivoted a short arm containing shallow hooks in which the welding cable can be coiled. To enable the line to be payed out to the welder on either side of the weld without having to drag the cable across the pipe, the arm is swung over the pipe, and the required cable turns taken off the hooks.

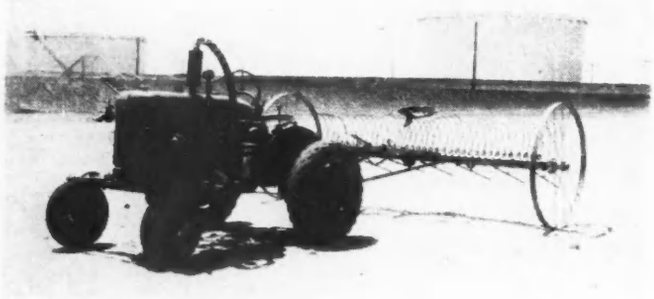
Photo courtesy H. C. Price Company.

Since much of the wear on welding leads arises through their being dragged over the pipe and against piled cribbing, use of the swinging arm adds much to the service life of the cable as well as reducing the work required of the welder and his helper.

When the skid is to be moved from one weld group to the next, it requires no more time to throw the loops of cable on the hooks than would be needed for winding the insulated lead on the usual storage drums carried on most skids.

HOW TO—Speed Cleaning Rights-of-Way and Yards

An expensive problem connected with maintenance of pipe line rights-of-way, stations and tank farm areas, is that of keeping those areas free of brush, tall grass and wind-blown weeds. Such operations are particularly necessary along rights-of-way, because pilots of pipe line patrol planes must be able to see the ground.



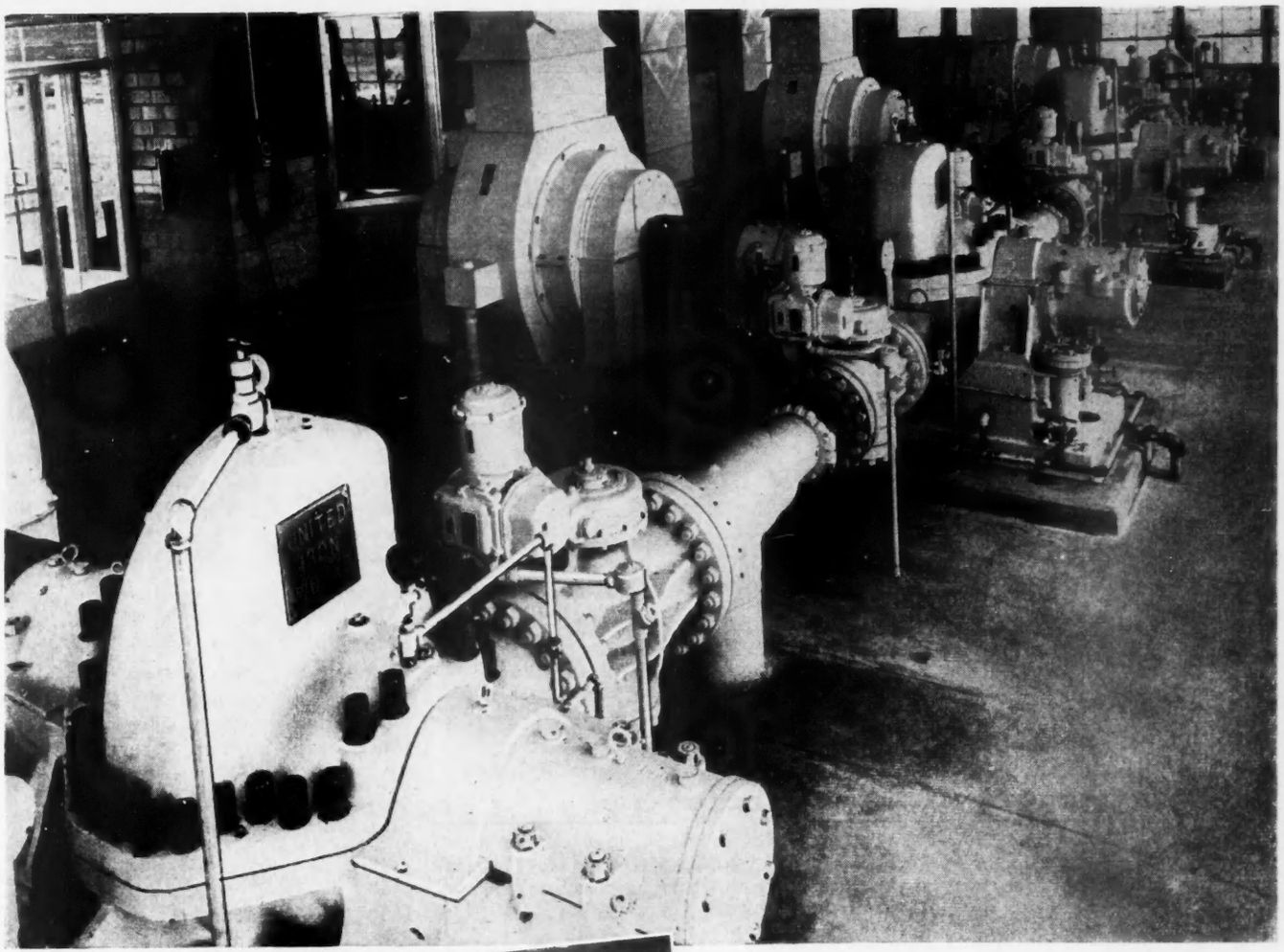
One pipe line company in West Texas has solved much of this problem with several pieces of conventional farm equipment, namely a tractor, mowing machine and rake. In one case, this equipment is used for clean-up work throughout an 80-mile radius area.

Work formerly done by hand now is performed by fewer men and in less time than formerly required. Pipe line rights-of-way easily are kept in good condition throughout the year and yard areas in the several stations are kept clean with little effort. The equipment is not difficult to move from job to job, being hauled on a flat bed truck.

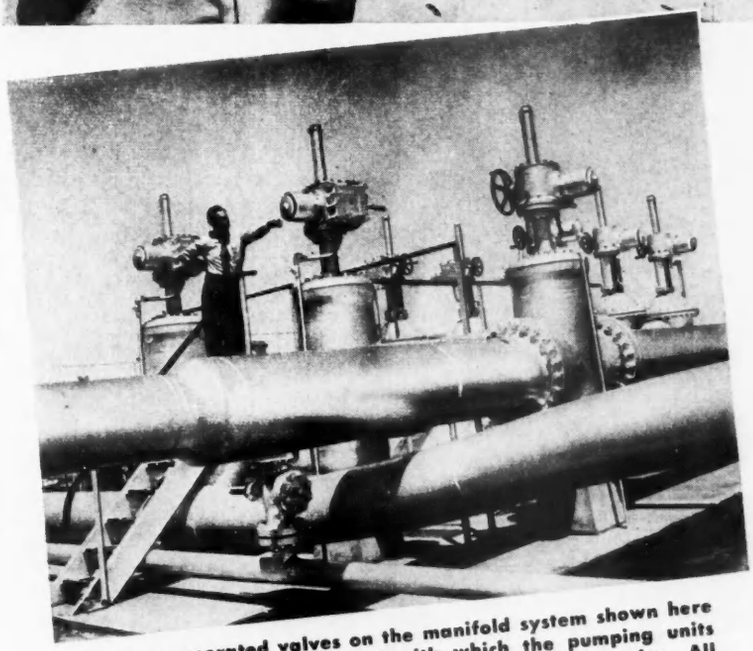
HOW TO—Connect Pumps to Engine for Flexibility

Where volume and pressure requirements vary over a wide range, one company uses two pumps connected to one engine. Gate and check valves are placed in the running line and the inlet, and the discharge of the pump is connected on either side. When the load on the line is light, the oil flows by gravity and no pump pressure is necessary. When the load increases, the engine is started and the clutch on one of the pumps is engaged. At the end of the month when several tanks are on the line at once, both pumps are run, thus doubling the capacity.

A header is placed at each of the inlet and discharge sides and both pumps connected to the same header. The pumps are the gear type and very little oil backflows through them when they are shut down, making it unnecessary to install check valves on each pump.



Interior view of a new and modern pipe line pump station showing three 1250 hp and one 500 hp, 1800 rpm, 4000 volt motors, direct connected to centrifugal pumps. This combination of motors and pumps provides great flexibility for varying throughput.



Motor operated valves on the manifold system shown here add greatly to the speed with which the pumping units may be put on the line or taken out of service. All motors are controlled from a central control board of the console type, simply by pushing buttons.

High Efficiency-- Low Power Cost

The use of utility electric service in this modern pipe line has made it possible for this line to be operated at a maximum efficiency at the lowest power cost. Modern automatic controls, together with safety and protective devices effect a great saving in manpower. Low original investment, with correspondingly less fixed charges, low maintenance, and high salvage value are advantages that users of utility electric service in pipe line operation can expect.

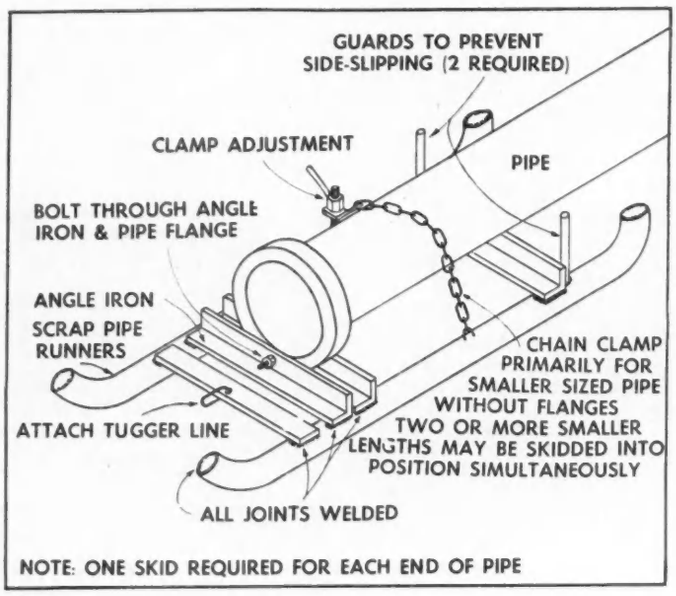
TEXAS ELECTRIC SERVICE COMPANY

HOW TO—Skid Heavy Sections of Flanged-End Pipe

Generally, heavy lengths of pipe are handled by motorized equipment; however, space restrictions often prohibit use of such equipment and other methods must be employed. The specially fabricated skid, illustrated, simplifies handling of the pipe and reduces positioning time in areas where motorized equipment cannot be used.

The skid is built of pipe with the ends turned up for runners and bridged, or spaced, by lengths of angle iron which support the pipe. Two skids, one at each end, are required for each length of pipe. As shown, the pipe flange is fastened to the front of the skid by a bolt through the angle iron bridges. At the rear, a guard is welded to each side of the bridging angle iron to prevent side slipping of the pipe. Since both ends of the runners are turned up, the skid can be moved backward in positioning the pipe.

The chain clamp is intended for use with smaller pipe without flanges, which cannot be bolted to the skid; however, it serves as a safety clamp on larger flanged pipe. The line from the air tugger is attached to a ring provided in the center of the front space bar.


GUARDS TO PREVENT SIDE-SLIPPING (2 REQUIRED)
CLAMP ADJUSTMENT
PIPE
BOLT THROUGH ANGLE IRON & PIPE FLANGE
ANGLE IRON SCRAP PIPE RUNNERS
CHAIN CLAMP PRIMARILY FOR SMALLER SIZED PIPE WITHOUT FLANGES
ATTACH TUGGER LINE
TWO OR MORE SMALLER LENGTHS MAY BE SKIDDED INTO POSITION SIMULTANEOUSLY
ALL JOINTS WELDED
NOTE: ONE SKID REQUIRED FOR EACH END OF PIPE

Sketch and material courtesy of "Coin Your Ideas" Committee, Esso Standard Oil Company, Louisiana division, Baton Rouge.

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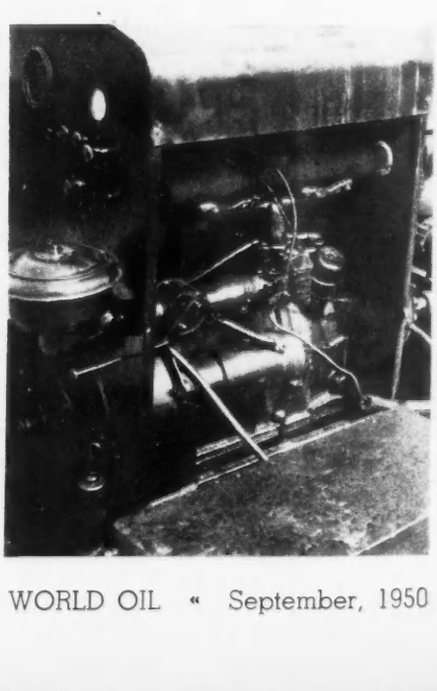
HOW TO—Convert Engine To Natural Gas

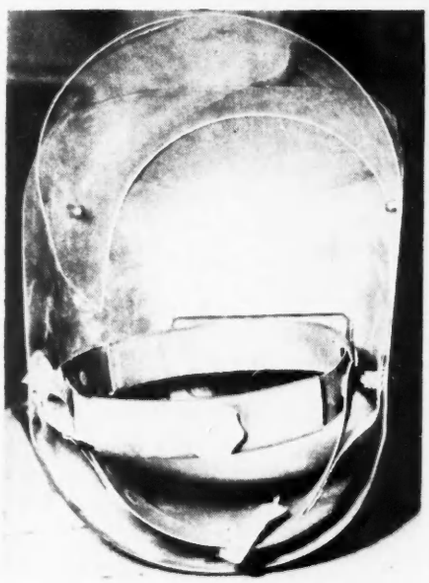
When a pump is installed at a pipe line station, it is usually run on gasoline until natural gas becomes available. A simple hook-up for connecting natural gas to the carburetor is shown. The drain plug is removed from the bottom of the carburetor bowl and a connection for copper tubing installed. The copper tubing is equipped on the other end with a bushing to make it fit snugly in-



side the rubber hose which runs from the gas regulator.

After the engine is started on gasoline, the graduated valve at the regulator is cracked and the gasoline shut off. The choke valve in the air inlet is used to control the mixture. After a little practice the operator may start the engine on natural gas by first partly opening the gas valve and then adjusting the choke connection for a rich mixture until the engine is warmed up.

HOW TO—
Add Safety Shield To Welding Helmet



A shield of clear plastic bolted to the chin rest of an electric welder's helmet provides protection during chipping operations and eliminates lost time in removal of the helmet and substituting safety goggles. A clear piece of plastic is cut in an oval shape and bent to fit inside the helmet. A hole on either side hinges the shield to the helmet so that sufficient space above the chin rest remains to swing the plastic shield out of the way for welding use.

After the welder has run a bead of metal on the work, the scale, formed during the fusing of the metal, must be chipped away before the next bead is run. Previously the welder had to remove his helmet and slip on a pair of goggles for protection from flying chips.

During welding work, the plastic shield swings up into the helmet in such a position that it does not become fogged. After welding, when the helmet is tilted back, the plastic shield is swung down out of the helmet for use.

(Courtesy "Coin Your Ideas" Committee, Esso Standard Oil Company, Baton Rouge, La.)

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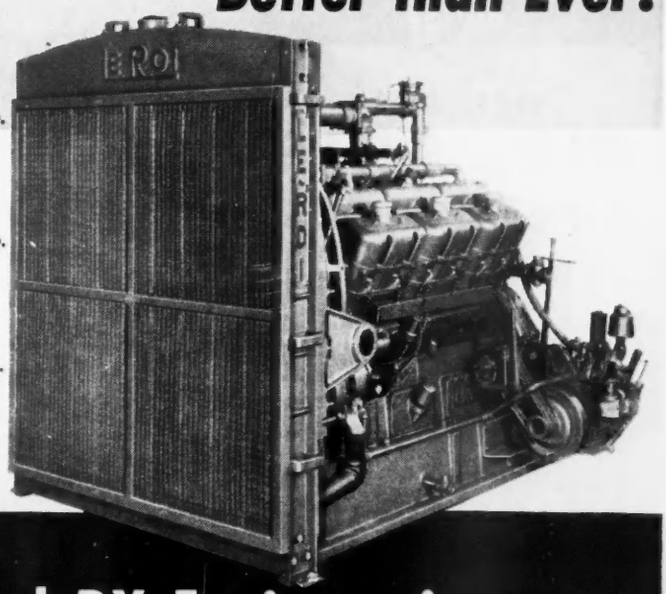

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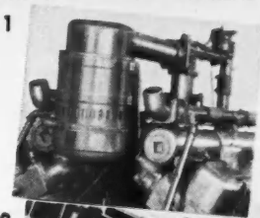
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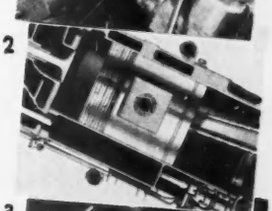
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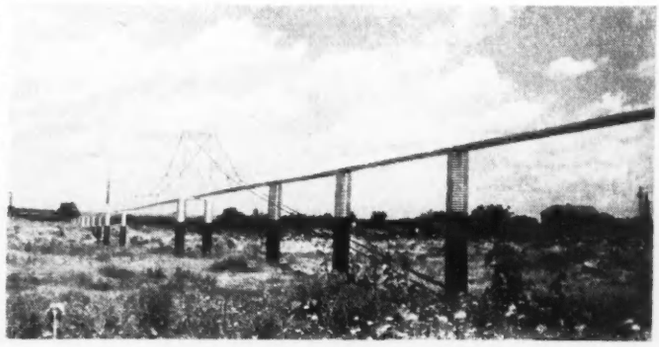
HOW TO—Construct Creek Crossing



Creek crossings in West Texas must be elevated above the creek bed in spite of the exceptionally dry climate and waterless creeks. Sudden downpours fill creeks with fast-moving water that might undermine buried lines in the sand and perhaps cause damage.

Here is an elevated creek crossing adequate in strength, yet not complicated in construction. The main span across the wide creek bed terminates on each side with double pier foundations and the pipe is supported by suspension cables.

Foundation piers are easily constructed, being made from corrugated culvert iron filled with concrete to provide strength and weight. Each pier is set well below ground level on a wide foundation block of concrete. Only single piers are required for the crossing approach. The line rests directly upon these piers, and is held in place by 2 metal tab guides set in the concrete.

The suspension cables are supported on each end by vertical pipe which extends down into the concrete piers. They are X-braced as shown, and cross-braced at the top. The suspension cables are anchored through turnbuckles to the bottom of the third pier beyond each double pier forming the suspension crossing. Steel cable slings are placed under the pipe across the creek span and attached to the suspension cables. Each end of the line crossing rests on the ground where provision is made for lateral expansion and contraction.

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The Undeveloped Oil Reserves of *Turkey*

By EMIL PAUL LORENZ

THE world oil reserves of approximately 8.6 billion metric tons (62 billion barrels) do not include the reserves that are as yet untapped within the confines of the 1 million square kilometers (386,100 square miles) of Turkish territory.

One of the greatest needs of Turkey today is the discovery of new oil fields, and the small republic will need assistance in this work —both technical and financial.

It is generally considered that the Ramandag field in Turkey is an extension or continuation of the Kirkuk field in Iraq, and the trend may very well extend up through eastern, central and western Anatolia to the Dardanelles and Thrace further up the Balkans and terminate in Galicia. There are numerous salt deposits in central and western Turkey, near which the writer found numerous signs of oil seeps.

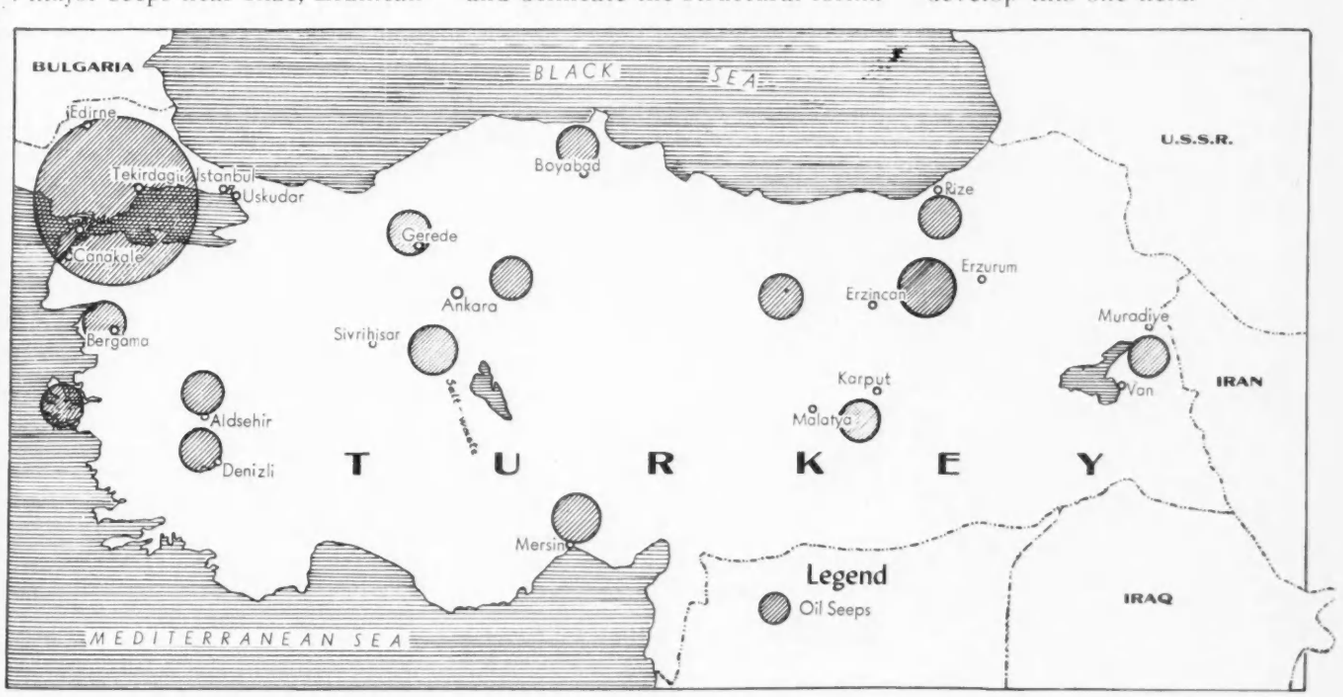
The first oil seepage is found near the frontier of Iran, east of Van, in the Muradiye territory. A little farther to the west are the 4 major seeps near Rize, Erzincan-Erzerum, Ramandag and Malatia-Karput. Other seeps occur near Boyabad, Gerede, Sivrihissar and Mersin, and in western Turkey near Denizli, Alasehir, Seferihisar and between the rural districts of Canakale and Edirne.

Very little exploratory drilling has been carried on in these areas with the exception of the Ramandag field which was developed about 3 years ago. The expense involved in this work is quite a big item. Turkey's annual oil needs are about 2,808,000 barrels and its present annual production just exceeds 1 million barrels. It is obvious that Turkey needs to look for more oil in geologically favorable areas.

The execution of all preparatory planning connected with the exploration for oil in Turkey, however, is handicapped by the nonexistence of all preliminary geological maps. To perform the work required to establish a geological survey, accumulate and interpret the fundamental geological data, and delineate the structural formations favorable to the accumulation of oil would take many years and huge sums of capital. Much of this time and expense could be eliminated by the use of a photogrammetric survey.

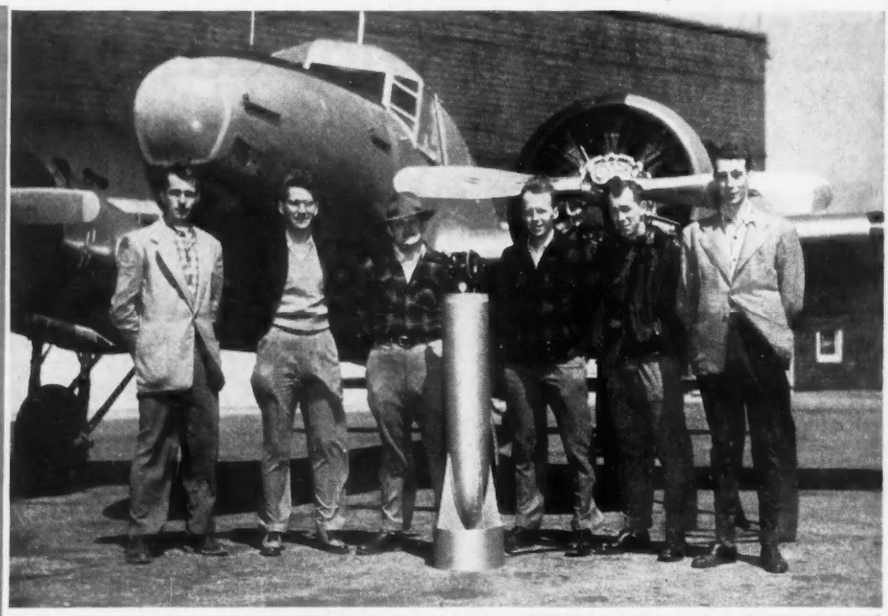
All mineral deposits in Turkey belong to the government but may be leased for a period of 60 years to Turkish citizens. In the case of oil, a concession granted to private interests must have a well drilled within a period of 2 years or the concession reverts back to the government. Concessions were granted in the Canakale and Edirne areas but were never drilled. As private Turkish capital was disinclined to explore for oil the government itself moved in and developed the Ramandag field. The country will not see full development of its oil resources until it permits foreign operators and capital to enter the country.

Although a beginning has been made at Ramandag, Turkey is far from supplying its own needs in oil and the government does not have enough money available to fully develop this one field.



Pictured with the magnetometer is the crew of the twin-engine Anson used in the survey. From left to right are William Ferderber, chief pilot; Jack Webster, project manager; Robert Pate, magnetometer operator; William McLaughlin and James Fox, data analysts; and Sam Taylor, pilot.

SURVEYING NORTHWEST Alberta will be simplified by the use of a flying magnetometer. Heavy timber and muskeg swamps in the region make ground surveying a long and costly proposition.



Alberta *Flying Magnetometer* Survey

TEMPO of the oil search in northwest Alberta received new impetus when the first large scale airborne magnetometer survey of the Peace River area was begun for four major oil companies by Canadian Aero Service, Ltd. Because of the large expense of the operation, and because of the general nature of the data which will be obtained, the survey is being undertaken on a cooperative basis by Socony-Vacuum Exploration Company, Stanolind Oil and Gas Company, Imperial Oil Company, Ltd., and Canadian Gulf Oil Company. Other oil companies have been invited to participate in the survey to extend the area of the operation, and it is believed there may be a 5th and possibly 6th company sharing in the exploration in the near future.

This pattern of jointly financed reconnaissance of a large area was first seen in a 5-company oil search in the Bahamas, followed by other cooperative airborne magnetometer surveys in Venezuela, Colombia, and Saskatchewan. The sharing of costs and data make it possible for all participants to obtain the regional picture important to geologists and geophysicists in their interpretation of magnetic data.

The aerial method is especially useful in the Alberta survey because the greater part of the area is heavily forested or muskeg country. Ground exploration is therefore slower, more costly, and more difficult than usual. Aerial magnetics will deliver a quick picture of 1 phase of the geophysical evidence for this very large area. From the survey the oil companies hope to learn something of the basement depths, basement structures, and other aspects of the rocks underlying the sediments. The precise magnetic map of the area which will be the end product of this extensive survey will enable the companies to make a valid evaluation of the magnetic method's worth in this exploration area. The Canadian oil industry is watching the survey for answers to the difficult problems of exploring the remote country of the north.

Shaded area of map represents the more than 16 million acres in Peace River area mapped in the survey.

One or 2 twin-engine planes will be used in the survey. The planes have been outfitted as complex flying laboratories. Their equipment includes a precise aerial mapping camera which records the path of the plane during the magnetometer survey, and several electronic recording devices. The new, improved, high sensitivity Gulf airborne magnetometer will be used for the survey.

The survey will be flown at an altitude of 1000 feet in a series of parallel lines spaced at 1½-mile intervals, with many intersecting control lines to correct for the severe daily variations of the magnetic field found in this part of the world. More than 16 million acres will be mapped. Flying will be completed in the early fall, and the data reduction and map compilation will be a continuing operation. The map sheets will be delivered simultaneously to all participants as they are compiled. Final deliveries of the maps will be made before the end of the year. The magnetic maps will be compiled at a scale of a mile to the inch, with a 5-gamma contour interval. The magnetic record will be precise to 2 gamma, a quantity only 1/25,000 as great as the earth's magnetic field being measured.

Project engineer for the survey is Jack C. Webster of Canadian Aero. The company will draw on its affiliate companies, Aero Service Corporation of Philadelphia for some technical assistance, and on Spartan Air Services, Ltd., of Ottawa, to provide the plane and flight personnel for the survey.

Russia May Try Again for Middle East Oil

By MARK OLSON
International Editor

RUSSIA does not now have enough oil for peaceful pursuits, let alone a major war effort. To develop its domestic economy to any great extent, Russia still produces from its domestic and satellite fields far less oil than it needs. With production falling off in Hungary and Roumania, the Russian Bear may begin foraging in other areas for this vital commodity. A logical candidate for such a move would be the oil-rich Middle East, just a short step south of Russia.

This possible development gains credence when it is realized that the oil production made available to Russia last year from the Iron Curtain countries averaged only 707,000 barrels per day. The comparatively small Middle East countries combined averaged 1,392,000 barrels daily for the year—with production curtailed to about half the present potential. In an emergency, Russia would have about 756,714 barrels a day immediately available to it, counting all the production of its own fields and those of Albania, Austria, Czechoslovakia, Hungary, Poland and Roumania. If production from domestic and satellite fields were 5 times the present amount, Russia's needs would still not be fulfilled. This is easier to comprehend when it is remembered that U. S. demand for oil during the peacetime year of 1949 averaged 5,792,400 barrels daily.

In view of recent developments, there has been increased speculation on Russia's true intentions in the Middle and Far East. A number of political analysts believe that the Korean episode is a smoke screen set up to conceal more important maneuvers in other areas. This is based upon the natural assumption that Russia had a hand in instigatng the war in Korea, and the fact that Russia persists in creating the impression that the tactically unprofitable campaign is important to the Communists. It is reasonable to doubt that the normally wily Communist leaders would risk a world war now over a piece of land half the size of Florida, but it is possible that they would take that calculated risk for a greater prize.

A wholly-Communist Korea would consolidate the Chinese mainland and provide a springboard for future jumps to Formosa, Japan and the Philippines, but this gain would not seem worth arousing the entire non-Communist world. On the other hand, it should not be discounted that the United Nations' reaction to Korea may have taken the Soviets by complete surprise, and where they intended to create smoke they drew fire. However, the amount of military

WHILE THE REST of the world is busy in Korea, Russia may try to "liberate" the Middle East oil fields. The U.S.S.R. credits itself with having saved the oil of Austria, Hungary and Roumania from imperialist exploitation and it is possible it will do as much for its neighbors to the south.

equipment and personnel thrown into Korea by the Communists would seem to refute this theory. The Korean war apparently was a well-planned campaign with a definite objective, and it is the task of the United Nations to determine just what the objective will be. Whether planned or not, Russia will probably move into some other area of Europe or Asia because the UN is tied down in Korea—or attempt to forestall an invasion of Manchuria in the event the UN forces are victorious.

Russia could move in several directions, but it is not likely that it wants more land on a continent which it now controls almost completely. The Great Red Bear and his cubs now hold enough land surface to keep them busy for the next 1000 years—if they were actually agrarians. Land is plentiful, but oil is not—and Russia intends to have oil by hook or crook. The country's hunger for oil is not pure conjecture when one recalls Russia stripping Austria's oil fields after the last war—long before a peace treaty was drafted betwen the Allies and Austria.

Russia is a past-master at annexing oil fields. The Baku oil fields, which produce about half of Russia's domestic supply, once belonged to the autonomous republic of Azerbaijan (not to be confused with Iran's province of Azerbaijan immediately to the south). Russia annexed the small republic in 1920 to save it from a fate worse than death. The following statement in the April, 1950, issue of the USSR Information Bulletin clarifies the republic's salvation: "The victory of the socialist revolution saved Azerbaijan from the horrible menace of becoming a colony of one of the imperialistic countries which coveted the oil riches of Azerbaijan. Azerbaijan has the right to maintain independent diplomatic relations with foreign states and the right of free secession from the Soviet Union."

Not even Texas enjoys such privileges, and it would seem that Iran, Iraq and Saudi Arabia would rush to the protecting arms of the Benevolent Bear—just as Albania, Austria, Czechoslovakia, Hungary, Poland and Roumania did a few short years ago.

With Iran forming part of Russia's southern border, and the rest of the Middle East oil fields a short distance away, it is inconceivable that the temptation to Russia is not at times overpowering. This is especially true when it is remembered that Russia, in the recent past, gained a substantial foothold in Iran by "legitimate" means.

Following Russia's entrance into the last war, thousands of Russian soldiers were stationed in northern Iran to protect the Caspian Sea area from possible German invasion. When fighting stopped in 1945, the Soviets were well entrenched in Azerbaijan, Iran's northernmost province, and Communist supporters began stirring up separatist feeling in the area. A left-wing party, known as the Tudeh, was fomenting riots in the capital city of Tehran. Russian troops stayed on in northern Iran encouragaing left-wing elements and strengthening the Tudeh party. In addition, the Kurdish tribes became troublesome, and as the Central Iranian government lost more control of the situation, a full-fledged civil war seemed to be in the making.

Reds Checked

Thinking its bargaining position would never be better, Russia began pushing for an oil concession along the northern Iranian border. The Premier of Iran checkmated them in this move by placing a demand before the United Nations that Russia be forced to remove its troops from Iranian soil. This event cost the Premier his job and he was replaced by a man thought to be "friendly" toward Russia. The new Premier intimated that Russia could have an oil concession when it removed its troops from Iran, and this condition, plus increasing pressure from the United Nations, forced the Russians out of the little country. Immediately following this withdrawal the Premier broke up the separatist movement in Azerbaijan and dismantled the Tudeh party. By returning power to the central government, the Premier felt that accord would be reached with the Russians by processes acceptable to the United Nations.

When the time came for the payoff, the Premier laid the oil proposal before the Iranian Parliament and the concession was summarily turned down. During the ensuing political struggle, the pro-Communist Premier was replaced by a strongly anti-Communist man and the situation has remained almost static since then. This "act of aggression" on the part of little Iran affected Russia much the same as a jet-propelled hornet would affect a bear bending over a pot of honey. The roars were heard for several months and the Russian Bear's hot breath has been blowing down Iran's neck since.

Iran has maintained a stiff resistance to further Russian demands for oil solely on the strength of U. S. support on the matter. In 1948 the U. S. began helping the Iranian government in a program of industrial modernization and military assistance which has displeased Russia intensely. A number of border incidents occurred during 1949, in the north, designed to make Iran see the error of its ways, but the country remained firm against the Russians. As late as June of this year, Russia protested strenuously to activities of oil surveying parties in northern Iran. Employing American experts, these surveys were carried on in behalf of the Iranian government to determine the possible presence and extent of oil deposits in that area. Russia, quite naturally, recognized these geological surveys in their true military sense and insisted that the work along the border was actually an act of military aggression.

Since Russia is practically "cornered" by these American and Iranian surveyors, the country can logically protect its sovereignty by a major "counter-attack" into Iran when the fancy strikes. With the rest of the world busily engaged in Korea, Russia may feel that counter-measures in Iran are timely. By watching military progress in Korea, Russia can gauge U. S. ability to extend military action to another front. If the American forces were effectively tied down in one small theater, Russia would probably not worry about possible interference in Iran. It is generally felt that an invasion of Iran would actually be a marching invasion, for though the Iranian army is American-trained and equipped, it would not be expected to put up much more resistance than the South Koreans if exposed to actual combat.

One possible deterent exists in Iran, however, that was not present in Korea. Iran has no active or legal Communist party to serve as a screen for Russian activity on the order of the Korean affair. As far as the outside world is concerned, the Communist party in Iran is

■ CONTINUED ON PAGE 270

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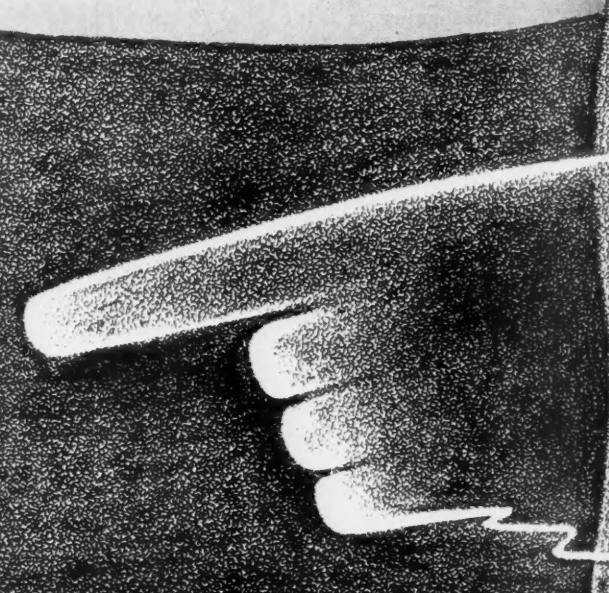

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RADIOACTIVITY

Well Logging in Canada

By S. W. McGAHA
Lane-Wells Company, Tulsa

RADIOACTIVITY well logging is playing an important role in the development of the oil producing areas in Western Canada and is assisting operators in attaining better well completions. Logs are being run in both newly completed and in old wells in Leduc, Redwater and other discoveries throughout Alberta although most of the present activity is within a radius of 75 miles of Edmonton.

Knowledge gained from these logs enables oil operators to make better identification of key markers in the upper, younger formations, this assists greatly in correlation and structural work.

Because every oil-producing province has its own peculiar characteristics—and this generalization can be narrowed down to a statement that each individual bore hole has characteristics all its own—the presentation of examples of typical radioactivity well log interpretations in Canada may prove interesting and fruitful to drilling and production engineers.

Much information can be gained from the gamma ray and neutron curves. One of the great advantages of these curves is that they can be made in cased hole as well as open hole and the curves obtained through casing will exhibit the same characteristics as those recorded in open hole. Moreover, the fluid within the well has little or no effect on the results.

During drilling operations, difficulty is frequently encountered in retaining and regaining circulation, in overcoming excessive cavings, in avoiding blowouts, etc. Under any of these conditions casing can be set in the hole below the source of trouble with the assurance that, by use of the radioactivity log, a complete picture of the stratigraphy can be obtained through the casing. The sandstones, limestones, shales and key-marker beds, together with the dense, low fluid zones can be easily interpreted by this means and the curves correlated with electrical logs, drilling times, core analyses and geological sample information. The depths of the formations are directly related to the position of the collars of the casing and the location of these collars is recorded at the time the gamma ray survey is being made. These casing collar locations serve as down-hole bench marks from which to measure all future testing operations.

In each well surveyed there are usually certain characteristic curves that can be observed. Most of these curve features will carry from well to well over a large area and can be used as markers. They may be of a dense sandstone, limestone, or dolomite, with a low gamma ray value and a high neutron response, reflecting a zone of no productive possibilities. They may be a productive type formation that will record a low gamma ray value and a low neutron value. There are sandstone and limestone formations contaminated with silt, shale or other foreign material that will be recognized by an intermediate curve response. Common shales usually show the highest gamma ray value with the lowest neutron value. In some cases fault planes and local unconformities are detected by unusual curve features. The zones easily recognized are those that contain an increased amount of radioactive material, much greater in percentage than the surrounding zones.

Most of the highest gamma ray values are associated with shale zones. The shales, as a general rule, will contain much more radioactive material than will a productive type formation. However, should a sandstone, limestone or dolomite be contaminated with a radioactive element—usually contained in silt, bentonite, ash or other contaminant—the curve will then approach the response of shale. There are only infrequent occurrences of the latter condition.

Figure 1 represents the upper formation of Cretaceous Age found in the Leduc field. The three wells A, B, and C, lie in a general north-south direction.

The top of the zone marked X is the approximate contact of the Lea Park-Colorado formations. The zone X is believed to be all within the Colorado. The gamma ray curve changes some in character and amplitude from well A to C. The neutron curve value is affected little, if any. Gamma ray curve characteristics of the magnitude shown through zone X represent a formation that contains a higher percentage of radioactive material than do the zones above or below. This type of curve response usually represents a zone or formation containing either a dark shale of marine origin, bentonite or bentonitic shale, volcanic ash or tuff, arkose or granite wash contaminated formations, or some other of a radioactive nature.

Zone Y, Figure 1, is still in the Colorado series. The upper half of this hori-

RADIOACTIVITY well logging is being used successfully in Canada to pin-point tops and extent of oil horizons. The method is especially helpful in checking zones through casing in old wells, as well as new wells which required early casing runs to combat lost circulation and caving conditions within the well. The author reveals a thorough knowledge of the various factors affecting radiation in Canadian wells.

zon has an average gamma ray value slightly more radioactive than the shale section that extends upward to zone X. The curve characteristics, on which the top of Y was selected, is usually rather easily identified on all surveys. This point approximates the top of the Second White Speckled shale.

The magnitude of the gamma ray curve for the lower half of this zone indicates the formation to be much more radioactive. This can also be observed as changing from one well to the other as it does in zone X.. The base of zone Y, reflecting a distinct change in curve character, is a good point to use for correlation work. The neutron curve in wells A and B does not show much change in character from top to bottom, which reflects the uniform fluid content of the shale. In well C numerous changes in the neutron curve response are noted. These may be due in part to changes in borehole diameter and partly to the nature of the shale.

The formations in the subject area are known to contain much bentonite, therefore it is logical to believe that a varying percentage of bentonite intermixed with a shale would reflect curve characteristics similar to those recorded by the gamma ray in zones X and Y.

Zones X and Y can be used as excellent markers for the upper formations. The wide extent of these two beds, with the thickness change of each formation and the change in interval of the two horizons, provides a good means of determining lower structural condition. The surveys run in Leduc, Redwater, and outlying areas, are all characterized by these two horizons.

In most localities where gamma ray-neutron logs are run, there are usually one or several sandstone horizons. The sandstone may be a clean homogeneous bed that will have a minimum value on the gamma ray curve. A high neutron value opposite this type formation would indicate it as being dry or of very low porosity. A low neutron value would indicate fluid.

The shaly or silty sandstone would record as gamma ray value of intermediate position between minimum and maximum values. The more shale or silt, the higher the gamma ray value. The neutron curve would have a similar intermediate position and would relate in reverse response the same curve characteristics as mentioned above.

Lenticular zones of sand and shale or silty sand and shale have a curve response similar to that of shaly or silty sandstone. The averaging effect of curve response of one thin zone to the other will usually place lenticular formations in an intermediate position. The recording of these thin lenses is controlled by the length of the recording chamber of the instrument. Thickness and character of the individual lenses also govern curve response. Should the horizon being traversed contain more thin sand lenses than shale, the curve will incline more toward a low value than if this condition were reversed. These factors must be considered in interpreting zones of this nature.

Many of the previously described conditions are exhibited in zone Z, Figure 1, which is believed to be the Viking series. The Viking in the Leduc area is a series of shales with inter-bedded sandstones, the sandstone being productive in a few wells where conditions are favorable.

The top member of zone Z in wells A and C, with the minimum gamma ray curve response, would be the best place within the zone for testing, providing the zone is productive in the area. The neutron curve opposite this horizon indicates relatively high fluid content.

According to the log, the remaining part of this formation in these two wells would indicate the zone as rather shaly, silty, or lenticular. Well B shows that these conditions exist throughout the entire zone.

The upper formations of Cretaceous Age, found in the Redwater field and outlying area, all exhibit curve characteristics similar to those shown on Figure 1. There are, however, changes in intervals and thickness of the existing formations.

Underlying the beds of lower Cre-

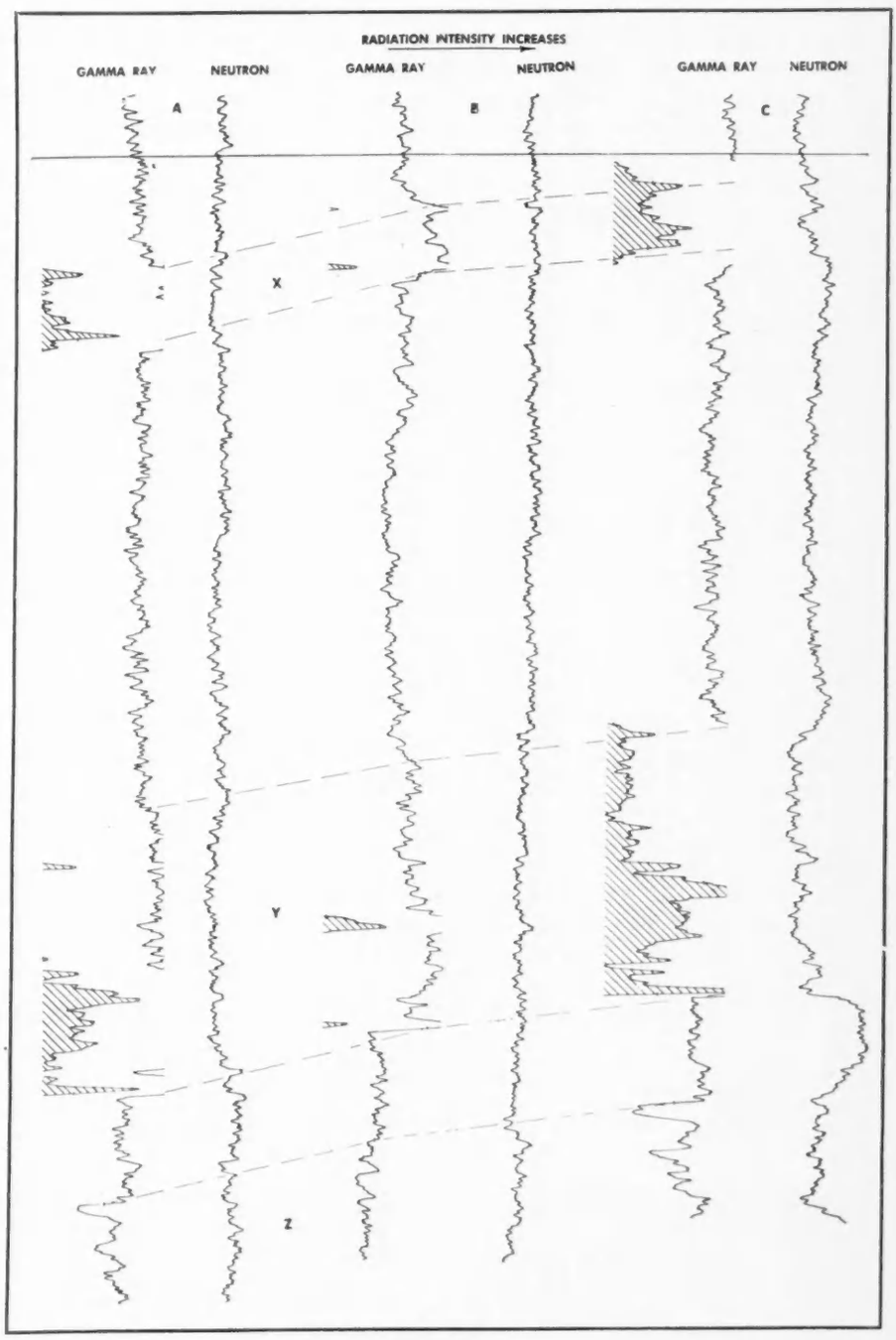

FIGURE 1

taceous Age in the Leduc area is a section of Devonian. There are 3 members or zones of this age composed of limestones, dolomites and shales, and they are listed in descending order as D-1, D-2, and D-3. These zones will be discussed in this sequence from the cross section depicted by the logs shown on Figure 2.

The descriptions of D-1 from sample cuttings relates an intermixture of dolomitic limestone, dolomite, limestone, anhydrite, shale, siltstones, and so on. Zone X is identified as the top portion of D-1, which is of high density and is greatly crystallized. This particular zone is present in all three wells but changes some in thickness. The neutron curve indicates the zone to be dense or barren by the extreme right hand curve position. This value is opposite an average gamma ray value for limestone type formations.

Reading downward to zone Y in well A, the gamma ray curve shows a shift or small kick to the right that would indicate a thin shale or silt contaminated horizon. There may be other shales or silt contaminated beds too thin to be detected. The gamma ray curve on well B shows 3 such thin beds in this zone. Well C shows numerous changes in gamma ray response that would indicate the zone to contain much more shale or contaminating material than do the other two wells.

The neutron curves through this section, in all 3 wells, exhibit numerous high and low values which show changes in the fluid content of the zone. There are fractures in this zone that contain oil staining. There are others containing shaly or silty material. In either case, the neutron curve records toward the low side. The denser streaks of limestone or the anhydrite beds having low fluid content have the opposite effect on the neutron curve and record toward the right. There are numerous thin, dense streaks that can be observed throughout this section, some of which are limestone or anhydrite.

The interval from Y to the Red Bed represents a zone that contains much anhydrite. The relative gamma ray value of anhydrite is similar to that of limestone, dolomite, and so on, but the neutron curve is usually more constant and records much higher. The high neutron values in this zone are believed to be caused mainly by the presence of such anhydrite. The change in the impurities and water of crystallization will vary the neutron response, which is noticeable in all 3 wells. The percentage of anhydrite present in this zone in each well is approximately the same; however, there is a change in its distribution.

The Red Bed zone is characterized as one that contains much shaly or silty material. This zone, being described as a siltstone, responds as a high value on the gamma ray curve and a low value on the neutron curve.

The D-2 zone, the original producing section in Leduc, is readily identified. The Red Bed zone above, and the Green Shale below, serve as distinct barriers. The formation is predominantly limestone, containing some dolomite, secondary anhydrite, silt, and argillaceous material.

The gamma ray curve in each well shows this section to be fairly uniform, with the exception of 1 or possibly 2 thin zones containing shale, silt, or argillaceous material. These thin zones can be identified by the gamma ray curve swinging toward the right and back to its approximate starting position. The zones vary from inches to a few feet thick from one well to the other. One such zone can be observed as a small kick to the right just below the top of the D-2 zone and carries through all 3 wells.

The neutron curve shows that the productive horizons within the zone change considerably in thickness and position. These zones are shown by the solid shaded area on wells A and B. Well A indicates that production is coming from one horizon at the bottom of the formation, with possibly some contribution by the upper zone, whereas well B shows the productive zone to be much greater in thickness and slightly more uniform. In well C the productive zones are thin, if present, and would be difficult to locate. This change in the productive zone is due to the change in crystallization, the vug type porosity being filled with secondary anhydrite or other materials or to the entire absence of primary porosity. The neutron value of well C being rather high, would indicate the absence of fluid.

The Green Shale between zones D-2 and D-3 is gradational from a shale containing a percentage of limstone, dolomite, and so on, to a pure shale, and this feature is shown by both the gamma ray and the neutron curve response.

The D-3 is the lowest producing zone penetrated to date in the Leduc area. The contact of this section and the overlying Green Shale is very sharp.

This limestone is a very prominent producing zone and gives reliable characteristics on both the gamma ray and neutron curves. The gamma ray curve shows the section to be uniform, with the neutron curve selecting the zones

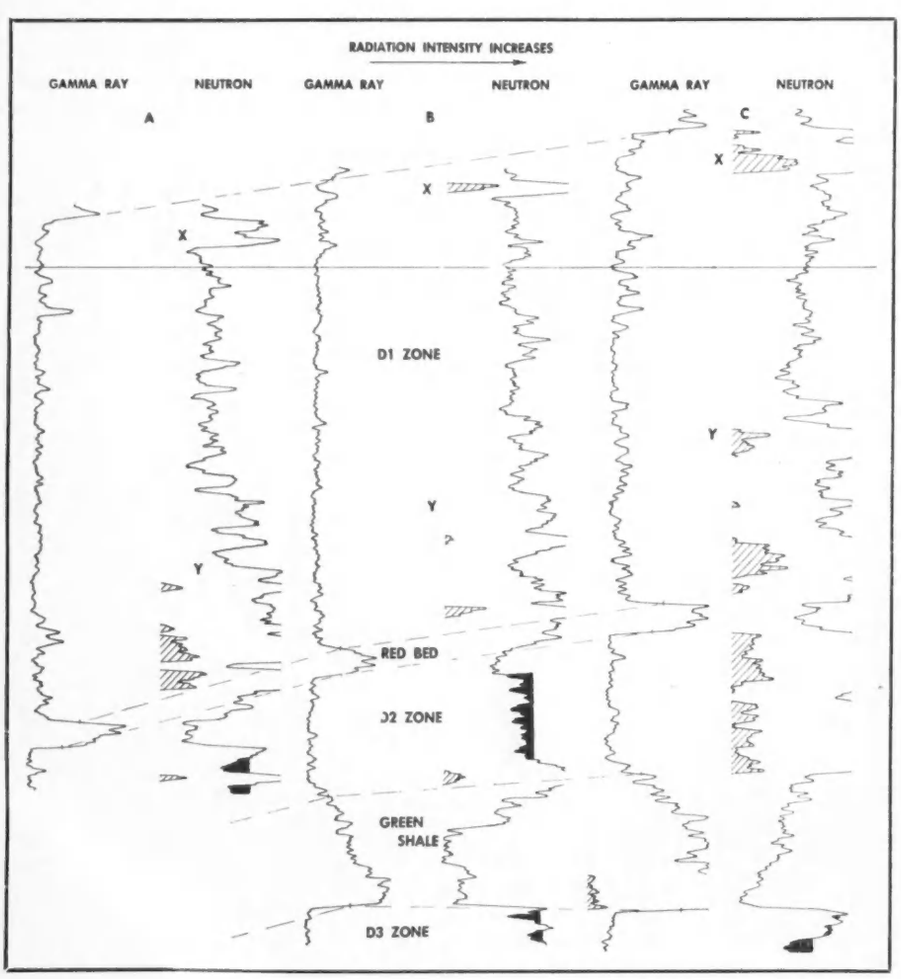

FIGURE 2

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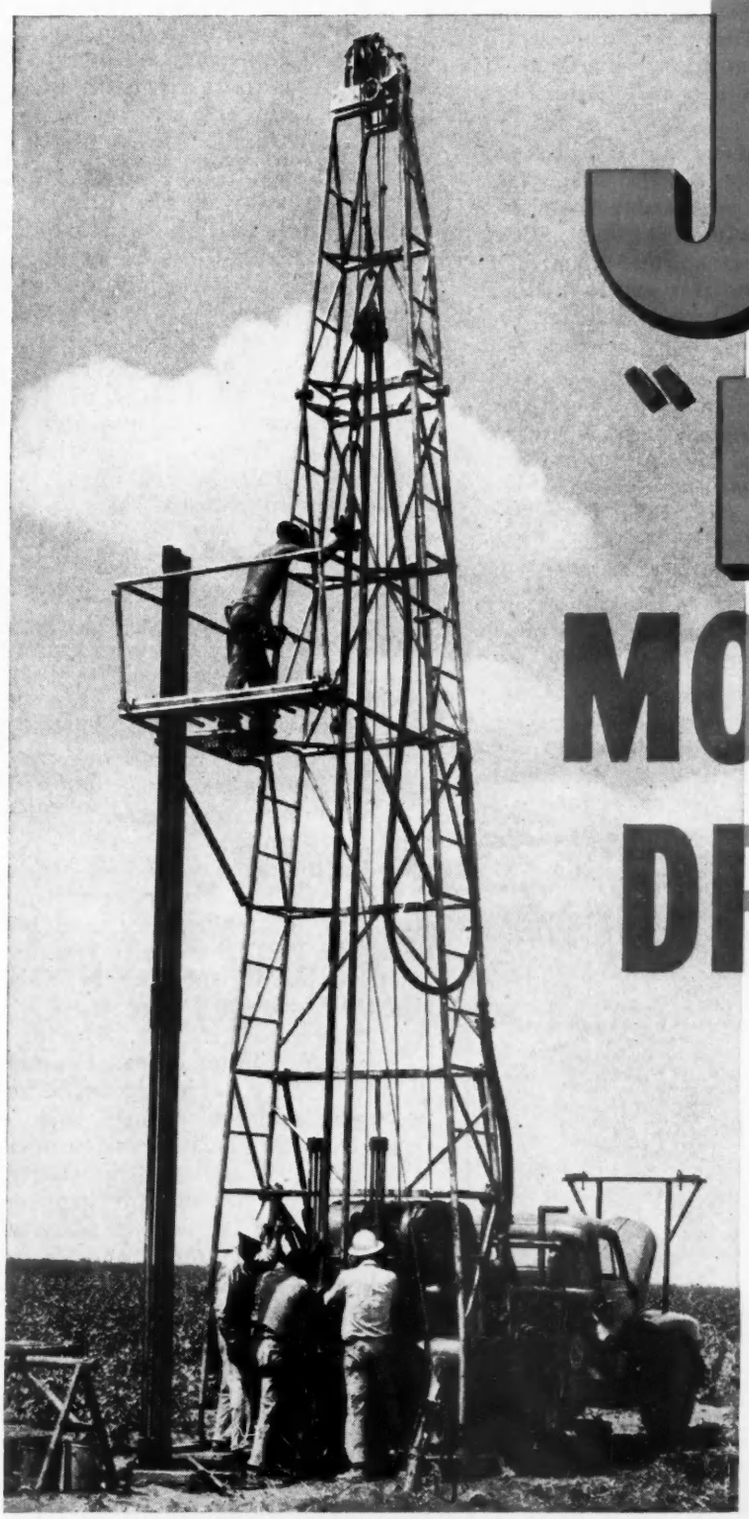

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that contain fluid. The thickness and position of the zones containing fluid (solid shaded area) change considerably from one well to another. This is a common occurrence in limestone producing formations.

The neutron curve shows 2 productive zones in well B. One is near the top of the formation and is separated from the other by a non-productive streak. In well C there are 2 thin zones indicating fluid that are located near the top of D-3. The main producing zone is shown by the solid shaded area at the bottom of this formation.

Figure 3 is a cross section of wells in the Redwater field representing a section from the Red Bed down to the lowest point penetrated in the D-3. The wells are located in a northwest-southeast direction.

The contacts of the D-2 and D-3 zones with the shale boundaries are rather sharp. The gamma ray value of D-2 is constant from well A to D, showing uniformity in character of formation, and being affected only slightly by change in interval. There is one point within this formation that is detected in each well by the gamma ray curve as being a shale or shaly zone. It is more pronounced in wells A and D than it is in the other two.

The neutron curve has a low value throughout, which shows the zone to be fluid-bearing from top to bottom. Testing results to date in this formation show the zone to produce much water.

The Green Shale horizon in Redwater is very similar to that in Leduc. It is, however, slightly less gradational, having much sharper contacts between it and the bounding limestone formations.

The D-3 is the oil producing section in the Redwater field. The limestone is fairly uniform as shown by the gamma ray curve, with slight indications of thin shales or silt-contaminated beds. These shaly zones can be best observed in well B. They may be present in many wells but are sometimes so thin that they are not easily detected on the logs.

The neutron curve shows that numerous horizons contain fluid. These zones change considerably in thickness from well to well, as can be seen by the solid shaded area. These changes appear to indicate that each well has its own producing horizon although some interconnection between horizons would be expected.

A dense non-productive zone is present on the top of this formation in part of the field and can be readily observed by the neutron curve response being high or toward the right. Other dense or non-productive beds are present throughout this formation.

The dotted line on the neutron curve, at or near the top of D-3, represents the casing point.

The combination radioactivity log consisting of both gamma ray and neutron curves is proving highly useful in this new area for determining the extent of the producing formations and the nature of the reservoirs within them. The information furnished by these curves cannot help but improve the completions of present horizons in the Redwater, Leduc and other areas of Canada.

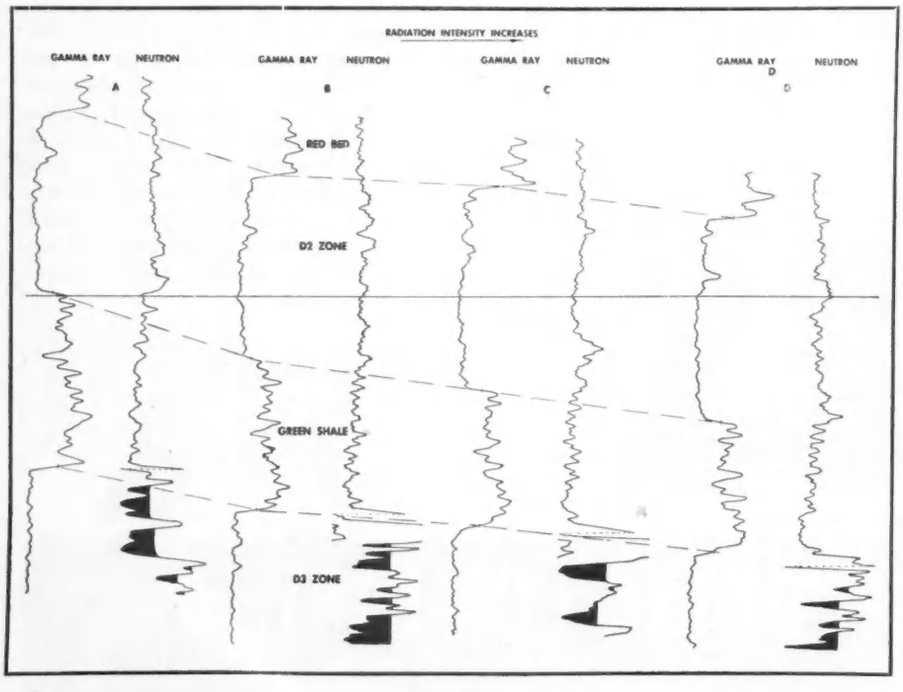


FIGURE 3

Russia May Try Again

■ CONTINUED FROM PAGE 264

small and dismembered to the point that any disturbance in the country would immediately be credited directly to Russia. Being branded as an aggressor might not seriously deter Russia from invading Iran, but it would effectively destroy its active fifth-column forces in countries not yet under Communist domination.

Depending on the Soviet view toward global war, the Russians may now feel that the gain would over-balance this loss of prestige if they could acquire huge quantities of oil as well as a good outlet to the Indian Ocean through the Persian Gulf. Russia's present oil supplies permit small, isolated campaigns such as the invasion of Korea, Iran, Turkey or Yugoslavia might require. However, for a sustained war on a global scale, Russia is seriously at a disadvantage. Any move toward the Middle East should be fairly indicative of Russia's future intentions.

The first move in this direction was not long in coming. On July 14, just 3 weeks after the start of the war in Korea, Russia filed a formal protest with Iran over the military supplies the latter country was receiving from the U. S. The timing is significant when it is recalled that Russia could have made the same protest 2 years ago. Russia claims that she has the right, under the 1921 treaty with Iran, to send troops into the country, now that the Soviets are "threatened by foreign activities in Iran." On July 19, Shah Mohammed Reza Pahlevi of Iran said the Soviet Union, in its propaganda blasts recently, misinterpreted the 1921 Iran-Russian friendship pact. He said the treaty provided for Soviet intervention only in the event of warlike activity on the part of counter-revolutionary White Russians. The Soviets probably assume that anyone who is not a Red Russian is bound to be a White Russian waiting to be "liberated."

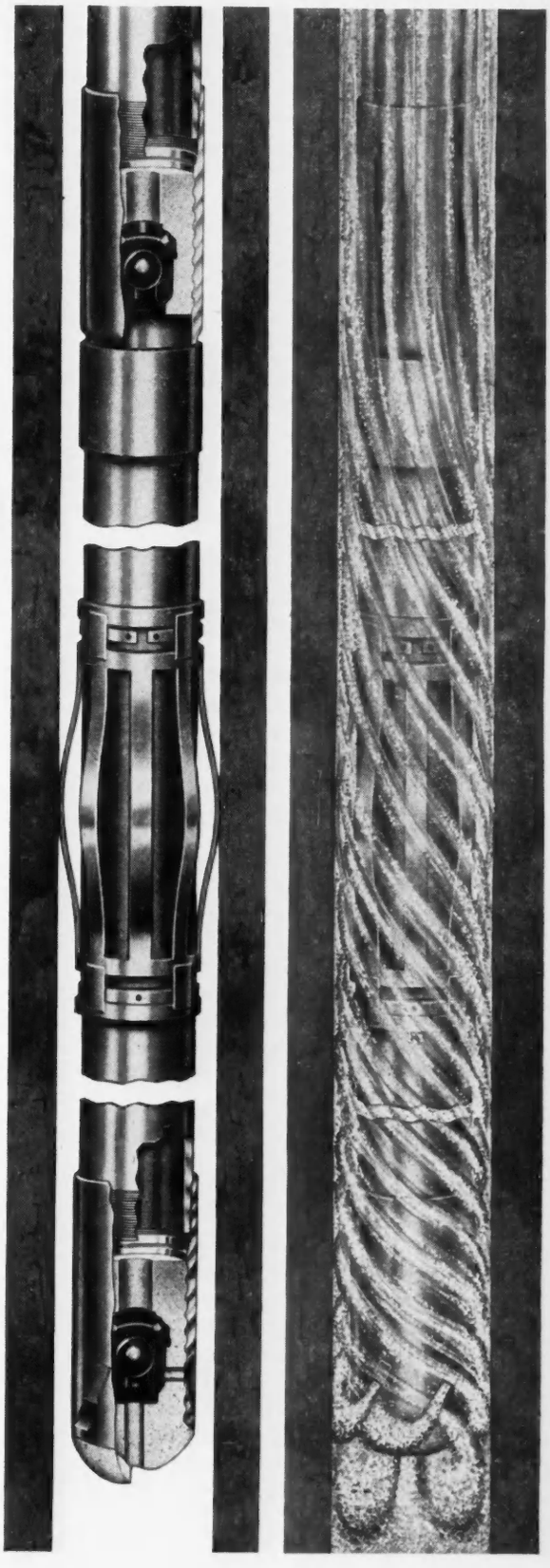
The present situation in the Middle and Far East could be analogous to a bear fishing for salmon in a mountain stream. While the bear waves one paw in the air to distract the salmon, the other paw scoops the fish out of the stream. For the oil of Iran and the rest of the Middle East, the Russian Bear may be willing to leap into the stream—provided it is not radioactive.

Knowledge=Cementing Success

There is nothing "just as good" as *Whirling* ON CENTER

THE DOWNWARD HYDRAULICKING ACTION of the fluid through the baffled, side down-whirler ports of a Baker Whirler Shoe, and through the nozzle-like bottom outlet, effectively removes bridges and permits safe running of the casing.

When washing the formation at the cementing point to condition the hole, the "whirling" motion of the fluid helps remove mud cake from the side walls. This *downward* whirling is far superior to any *side* jetting action.



The view at far right shows the "whirling" motion given to the cement slurry as it is discharged from a Baker Cement Wash-Down WHIRLER Float Shoe, with the shoe joint centered by means of a Baker Model "G" Casing Centralizer. *This same whirling motion given to the circulating fluid, conditions and prepares the wall of the hole immediately prior to the discharge of the slurry.* The whirling action of the slurry, in turn, not only supplements the hole conditioning process, but also ensures that the centered casing will be completely encased with a uniform body of cement and that the hazard of channeling will be reduced to a minimum.

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KEY TO CEMENTING SUCCESS

Gulf-Sicilian Pact Arouses New Interest in Oil Concessions

SIGNING of the new agreement between Gulf Oil Corporation and the Sicilian Regional Government has resulted in an unexpected flurry of excitement in the Mediterranean island with 3 companies evidencing their interest in the search for oil.

Gulf's subsidiary, American International Fuel and Petroleum Company, got the first start with its permit-concession covering 100,000 hectares (247,100 acres) in the vicinity of Ragusa, in the southeastern part of the country. This was signed July 4, and shortly thereafter it was reported that Macmillan Petroleum Corporation and British Anglo-Iranian Oil Company were initiating negotiations with the Sicilian government. Macmillan holds option on about 91,000 acres under the former Sicilian law, but is now compelled to re-negotiate and to complete requirements of an earlier work program. Anglo-Iranian representatives were reported visiting Sicilian officials in Palermo for concession talks.

Gulf's agreement, signed in the name of American International, likely will form the basis of any future grants. The contract was to take effect on official publication in August. Under it the company is obligated to conduct a flying magnetometer survey, to do a specified amount of structure drilling, and to start a deep test within 3 years. Actually, the aerial magnetometer work has already been completed and fulfills the company's obligations until early next year when a seismograph crew will be sent to the island. American International is expected to delay choice of its first location until 1953.

The American International agreement covers 2 time phases of operation, a "research phase" (exploration period) and a production period. The exploration period itself is divided into 3 sub-periods of 3 years each with the company having the right to hold its grant for the full 9 years providing work obligations are fulfilled. In the event of a commercial discovery of oil or gas made before the expiration of the full 9-year period, American International will have the right to a 30-year operating concession covering at least 60 percent of the original area. If no commercial discovery is made, the permit-concession will lapse. A commercial discovery is defined in the agreement as an oil well yielding at least 100 barrels of water-free, 15-degree API gravity crude for 24 hours; or a gas well producing at least 15,000 cubic meters (525,000 cubic feet) per 24-hour day.

The company is given rights to produce, transport, store and dispose of all oil or gas discovered, in either the exploration or the production periods. The company likewise retains full choice of techniques, processes and methods with the qualification that all work done must be in accordance with good industry practice.

The royalty rate for gas is a straight 10 percent, but for oil is a variable schedule based on the cubic meter yield of the well (1 cubic meter equals about 6.3 barrels of oil). This sliding scale begins at 7 percent for production up to 5000 cubic meters, 8 percent on 10,000, 9 percent on 20,000, and 10½ percent on 50,000 cubic meter yield. On production of 100,000 cubic meters the rate goes to 12 percent.

A feature of the royalty provision is that the Sicilian government has the right to exempt the company from income taxes and in compensation therefor to increase the royalty schedule by 10 percent in each bracket. Another important clause provides that the contract can be modified only by the mutual consent of both the company and the government.

Airborne Magnetometer Survey Completed in North Tunisia

Flying of North Africa's first airborne magnetometer survey was completed this summer for the Gulf Exploration Company. Approximately 20,000 square kilometers in north-central Tunisia were flown to begin the company's oil exploration program in the area.

Magnetic mapping of the area was done in less than 30 days with the new, improved, high sensitivity Gulf Airborne Magnetometer. A record accurate to variations as small as 1 gamma was obtained. The data will be compiled by Aero Service Corporation, the company which made the survey, in magnetic intensity maps at a 5-gamma contour interval. The maps will be delivered this year for study by Gulf geologists and geophysicists. Aerial photographs made during the course of the survey will also be studied stereoscopically.

A specially outfitted twin-engine transport was used for the survey. It was the same plane Aero Service employed in last year's oil survey in Mozambique and in mineral surveys in the Union of South Africa. In 1947 the plane and some members of the Tunisian survey staff performed the large-scale magnetometer survey of the Bahamas.

Tropical Continues Marketing In Colombia Under New Name

International Petroleum Company, Ltd., announced that it has transferred the marketing assets of its Colombian affiliate, Tropical Oil Company, to a newly formed company, Esso Colombiana, S. A.

Currency exchange control authorities under the Colombian Minister of Finance, Dr. Hernan Jaramillo Ocampo, have made the new marketing arrangements possible, International, an affiliate of Standard Oil Company (N. J.), said, by providing that the marketing assets of Esso Colombiana shall be registered as imported foreign capital. As a result, dividends earned by the new company are subject to remittance to the foreign shareholders.

"This action on the part of the Colombian government," International Petroleum stated, "has confirmed statements of policy by the members of the present administration to the effect that foreign capital is welcomed in Colombia and will be given equal treatment with Colombian capital."

Recent statements by Dr. Laureano Gomez, who assumed the presidency of Colombia on August 7, indicated that his government also will subscribe to a principle of favorable treatment to private foreign investors and that they will continue to be welcome in Colombia, the company added.

Meanwhile, Tropical Oil Company will continue its producing and refining operations in Colombia until the expiration of the DeMares Concession in August, 1951.

Tropical advised the Colombian government in November, 1949, that after August, 1951, the company was unwilling to participate as a producer in the DeMares Concession on a minority interest basis as would be required under the terms of Colombian legislation adopted in December, 1948. At the same time, Tropical indicated its desire to remain in business in Colombia.

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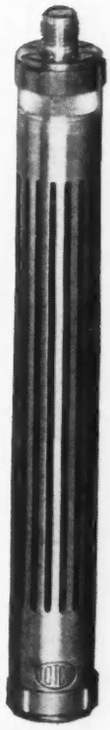

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Way Open for Drilling in Persian Gulf

LEGAL snarls involving drilling rights in the Persian Gulf have been resolved to the point where the way is now open for the first offshore tests in the lush tidelands of the Middle East.

King Ibn Saud of Saudi Arabia on May 28, 1949, signed a decree declaring his right to control over the sea bed and sub-soil of the sea adjacent to the Arabian Peninsula in the Persian Gulf. This was quickly followed by similar pronouncements by the small principalities along the Gulf, all these decrees fixing a 6-mile belt of coastal seas as territorial waters. The Saudi Arabian declaration also defines "inland waters" as all those between Saudi Arabia islands not farther than 12 nautical miles and including all bays and waters between the mainland and the islands.

The claims of the Arab states have been prompted by the Truman Proclamation of September 28, 1945, concerning the continental shelf of the U. S., but it is noteworthy that the Arab claims are not limited, as is the American, to the natural resources of the sub-soil and the sea bed. To the present, these claims have been advanced by Kuwait, Bahrein, Qatar, and the Sheikdoms of the Trucial Coast (Abu Dhabi, Sharjah, Dubai, Ras al-Khaimah, Ajman and Umm).

The Shiek of Qatar submitted his claims to arbitration and accepted a decision that Qatar's concession grant to Iraq Petroleum Company included only land rights and that the shiek could grant water rights. These rights then confirmed the previously made grant to The Superior Oil Company and Trinidad Leaseholds. IPC had sought recognition to its rights over the entire sheikdom and adjacent waters, but was confirmed in its holdings only to the territorial waters and the islands in addition to the land rights. This ruling left Superior's concession valid only on the Qatar continental shelf, dominion territory.

Several undecided points remain. The sheik of Qatar has not yet declared the extent of his territorial limits, but may accept the 3-mile limit as recommended by the British Foreign Office. Also, the question of territory boundaries is still unsettled between Qatar and Bahrein and Qatar and Saudi Arabia. It is conceivable that Superior may get some promising oil rights on the west side of the Qatar Peninsula, on the same side as the Dukhan field.

Bahrein's ruler claims all offshore rights, and the issue had not been fully settled for Kuwait.

The Persian Gulf is much more shallow than the Gulf of Mexico and easier drilling operations are expected there.

Still awaiting determination before the companies actually start offshore work are stipulations for the drawing of base lines with which to measure the 6-mile limits. Also, some remaining conflict in inter-principality claims must be resolved among the Persian Gulf rulers.

The Arabian American Oil Company has confirmation of its water rights off Saudi Arabia, and Bahrein Petroleum Company is certain of its rights. As a result these companies have been most active in offshore exploration.

Exploration in Italy Extending Into Central and Southern Areas

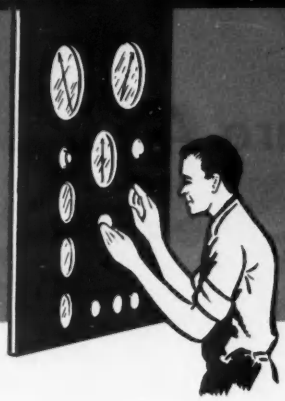
THE exploration for oil and gas in Italy is presently extending from the Po Valley into central and southern Italy. The Montecatini General Mining Company of Milan has been carrying on a geological survey in the Porto Recanati region south of Ancona. On the basis of preliminary data obtained with this work, a wildcat is presently drilling at 5720 feet in the area. An oil structure was reported to have been found in this well but no conclusive tests have been obtained from the formation as yet.

The Azienda Generale Italiana Petroli (AGIP), the government oil agency, is also carrying on geological reconnaissance in the Chienti Valley of Marches province. Actual exploratory drilling operations are said to be going on there at this time, although no definite data are given as to locality or results. The Ente Nazionale Metano organization is carrying on geological work in the same area, concentrating on the entire region from the mouth of the Potenza River on the Adriatic to the Treja Pass. This same group has recently found substantial gas deposits near Aquila in Abruzzi province.

North of Modena, in Emilia province, AGIP has completed a small oil producer at 4950 feet. The well initially tested 15 barrels of oil per day and the well will be reworked to try to improve production. As this is wildcat territory, more wells will probably be drilled in the area soon.

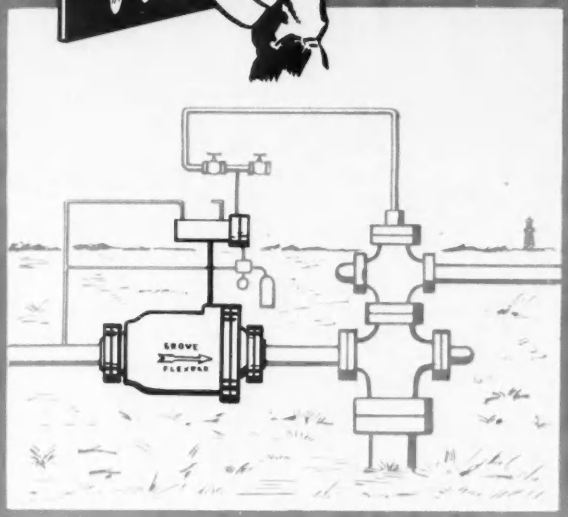
Two refineries operated jointly by Standard of New Jersey and Azienda Nazionale Idrogenazione Combustibili will be expanded shortly. Following this work, the refinery at Bari will have an annual output capacity of 1,061,060 barrels of gasoline, 1,124,000 barrels of fuel oil, 959,000 barrels of diesel oil, 148,700 barrels of kerosine, 277,000 barrels of bitumen, 38,100 barrels of solvents and 42,500 barrels of liquid petroleum gases. The refinery at Leghorn will have an annual output of 3,620,000 barrels of gasoline, 3,850,000 barrels of fuel oil, 1,693,000 barrels of diesel oil, 462,000 barrels of lubricating oil, 362,000 barrels of kerosine, 277,000 barrels of bitumen, 146,200 barrels of liquid petroleum gases, 46,200 barrels of solvents, 13,000 tons of coke and 6000 tons of paraffin.

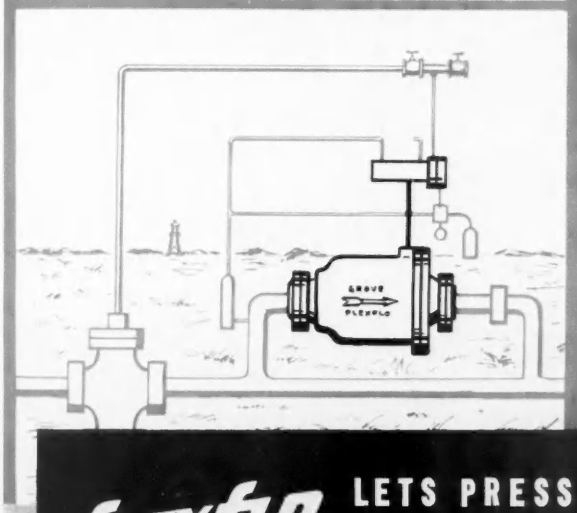
Italy may have sustained a serious setback in oil operations in the Po Valley late in July with the announcement that a state monopoly was to be set up over the entire region. This state control of the Po Valley has been predicted for some time but as late as last fall it appeared that the government intended to leave the operation of oil properties in private hands.



GROVE REMOTE CONTROL

PRESSURE OPERATED *flexflo* VALVES



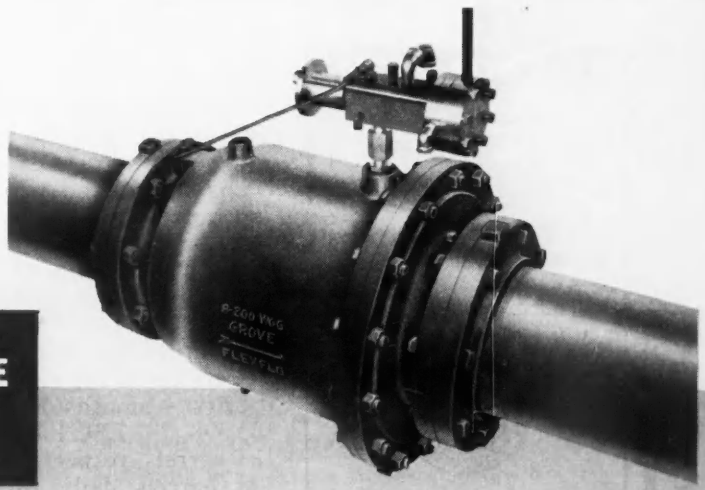


The pressure in the line does the work, opening the FlexFlo with a smooth, rolling action, or closing it with a bubble-tight seal. No manual or mechanical force is necessary in its operation. So the FlexFlo can be operated from a distance as easily and surely as if the operator were at the valve.

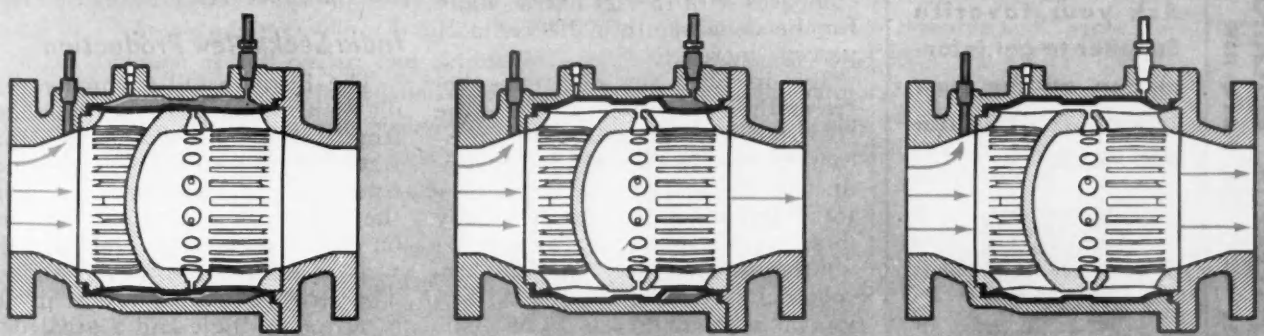
A twist of the wrist at a remote panel releases or applies pressure to the diaphragm of the control pilot mounted on the FlexFlo. This pilot uses the actual line pressure to open or close the FlexFlo with a fast, positive action.

The simple FlexFlo design has been proved in more than ten years of hard service to be unequalled for dependability and long, trouble-free life in the control of air, gas, oil, water, and salt water at temperatures to 150° F. and at pressures to 1500 psi.

Let the Grove FlexFlo engineer show how this dependable remote control valve will increase the efficiency of your plant's operations. Write for full information.



flexflo LETS PRESSURE DO THE WORK



The only moving part in the Grove FlexFlo is a tough Buna N tube, which fits closely around a slotted metal core. When closed, line pressure from within, tending to force the tube off the core, is opposed by equal line pressure on the outside of the tube. Equalizing the inner and outer pressure allows the elasticity of the tube to grip tightly around the core with a positive, sealing action.

As the control pilot closes off line pressure acting on the outside of the tube, inner line pressure, being greater than the outer, begins to roll the tube off the core, opening the FlexFlo.

When pressure on the outer side of the tube is entirely removed, the inner pressure forces the tube completely off the slotted core, opening the valve wide and permitting free flow.

GROVE REGULATOR COMPANY

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New Contracts Assure Added Drilling Activity in Mexico

MEXICO's increasing aggressiveness in oil exploration was emphasized with the announcement that 2 more U. S. drilling firms have been given contracts south of the border. Sharples Oil Corporation of Denver and Independent Exploration Company of California have signed with Petroles Mexicanos to drill for oil on essentially the same basis as the Pemex-American Independent Oil Company contract.

The latest contingent-drilling contracts will give the companies half the oil they find, until their expenses are recouped, and 15 percent of the production from the wells for 25 years. No compensation will be made for dry holes. Sharples will drill along the Golden Lane fields in Vera Cruz state and Independent Exploration will operate in Tamaulipas state around the Reynosa field, across the border from McAllen, Texas. The latter company is headed by Edwin W. Pauley, who is associated in the venture with the Locke Brothers of Long Beach and Ponce Davis of Oakland.

Meanwhile Pemex is carrying on an active drilling campaign in all parts of the country, which is reflected in the increasing daily oil production. The daily average oil production for 1949 was 166,400 barrels while the daily average for the first 4 months of this year were 183,398, 187,779, 188,867, and 193,-123 barrels, respectively. The 193,-123 barrels daily for April 1950 compares with 159,621 barrels daily for the same month in 1949 as a 21 percent increase.

By districts, the difference between the two periods is due to the following conditions: 1) Northeastern—no further crude oil production developed. 2) Northern—total decreased 1606 barrels daily despite 12 new producers. 3) Southern—total increased 6496 barrels daily. Moralillo and Alazan increased from 1972 to 11,667 barrels daily—thus other wells in the Southern district decreased 3199 barrels daily. 4) Poza Rica—total increased 26,228 barrels daily. New wells brought Escolin field from 46 to 8790 barrels daily, and Miguel Aleman field from 0 to 88 barrels daily. The old wells at San Miguel-Mecatepec were increased from 13,297 to 16,535 barrels daily, and the old wells in the Poza Rica field proper were increased from 82,837 to 96,995 barrels daily. 5) Isthmus—total increased 2374 barrels daily. El Plan field was raised from 10,901 to 12,686 barrels daily, Acalapa from 1782 to 2041 barrels daily and Moloacan from 0 to 311 barrels daily. Mexico's peak oil productive year was 1921 when total output was 193,398,000 barrels—or a daily average of 530,000 barrels.

Mexico's exports of crude oil and products will probably reach an all-time peak this year, 10,828,-852 barrels having been exported the first 6 months. Total exports for the year 1949 were 13,581,388 barrels, and for the year 1948 they were 12,097,901. For the 6-month period, 7/10 of the exports went to the U. S. to maintain dollar income. With the remainder of the oil going to countries other than the U. S. the isthmus country hopes to establish barter trade for industrial machinery and especially oil field equipment.

Whether cancellation of the U. S.-Mexico reciprocal trade agreement on December 31, 1950, will seriously affect oil exports is problematic. Mexico will probably be inclined to trim its exports to the U. S. somewhat because of the higher tariff, but this will depend on Mexico's ability to develop barter deals in Europe and possibly Japan.

India Seeks New Production

The Burmah Oil Company (India Concessions), Ltd., announced from its Digboi headquarters that traces of oil have been reported at its Barsilla, Assam wildcat, where the company is actively carrying on exploratory work. Depth of the well in early June was 5300 feet. The location of the well is in impenetrable jungle and a great deal of road cutting was necessary before the well was started in March.

East Pakistan anticipates stepped up exploratory drilling in the near future following a settlement of the frontier dispute in the area of the Patharia forest reserve on the Bengal-Assam border.

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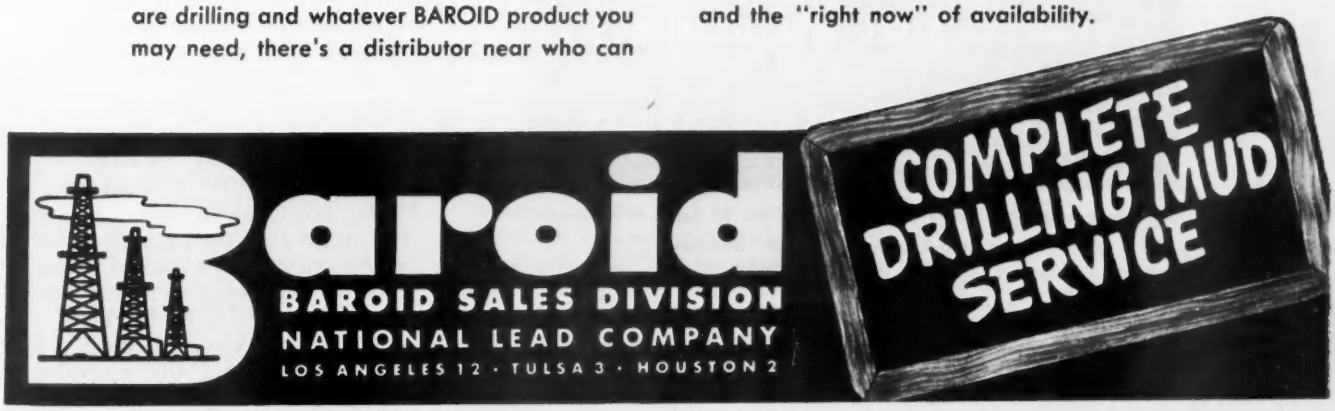


U. S. Firms Resist ECA Price Cut Aims

By HENRY OZANNE
Eastern District Editor

American oil companies operating out of the Persian Gulf are successfully resisting pressure by the Economic Cooperation Administration to force a reduction on delivered prices of petroleum products shipped to Turkey and Greece. There is indication that ECA is changing its position on this problem in favor of more lenient rules for industry.

ECA notified American oil refiners at the Persian Gulf at the close of last year that the agency, effective January 31, 1950, would not finance further shipments of refined products to any country in Europe at a higher delivered price than that for the United Kingdom. ECA called on the American companies to specify how they would eliminate "substantial net-back" prices at Persian Gulf refineries on shipments to Eastern Mediterranean and European ports.

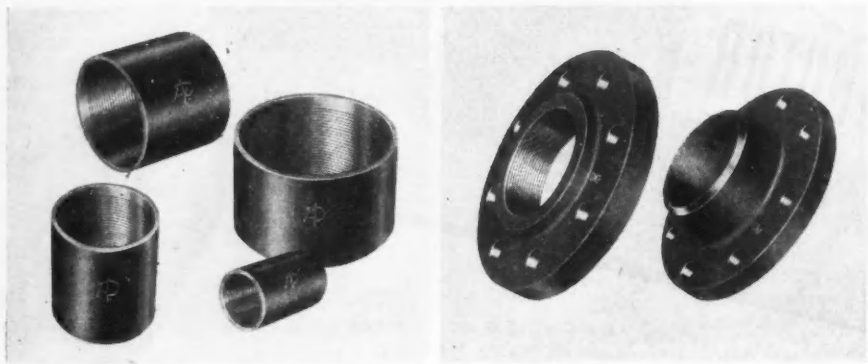
The issue arose from the fact that lower delivered prices are charged the United Kingdom than are charged at the intermediate points of Turkey and Greece. This situation is explainable because Persian Gulf refiners quote for U.K. delivery the competitive price as posted at U. S. Gulf Coast refineries and the Middle East operators absorb the higher transportation cost involved in the longer haul to U. K. delivery points. This pricing practice thereby allows Persian Gulf refiners to be competitive with laid-down product prices shipped from the Gulf Coast and the Caribbean.

A transportation allowance of about $4.35 a ton (60 cents a barrel) is deducted at the Persian Gulf on shipments to the U. K., and about $1.85 a ton (26 cents a barrel) on shipments to Western Mediterranean ports.

During the last 3 months ECA has sent several drafts of letters to the American companies asking approval of a new pricing formula which would consider Italy as the "watershed" of Western delivery movements, and would cut about 70 cents a ton off the delivered price of shipments to Turkey and Greece. The companies have refused to accept these drafts and ECA has not yet seen fit to issue an order, and continues to finance oil shipments to Turkey and Greece despite its earlier announcement that it would cease to finance such shipments. Some of the companies now question ECA's legal authority to impose such a pricing structure.

ECA based its original contention on the argument that Turkey and Greece should not have to pay more for, say, fuel oil than does the U. K., which is farther away. The industry's pricing pattern is based on the competitive fact of the nearness of the source of supply. In this sense the U. K. is closer to a competitive source of supply (the Gulf Coast and the Caribbean) than is either Turkey or Greece.

IF YOU USE . . .



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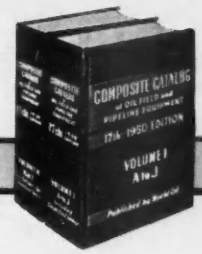
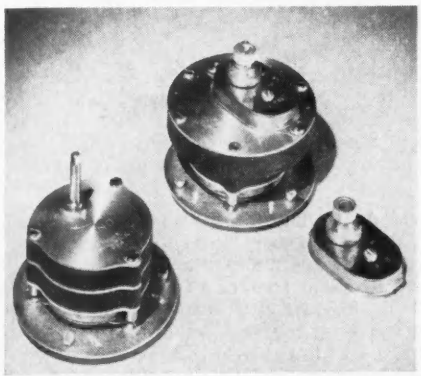


304 — Mechanical Drives

This item supplements Pittsburgh Equitable Meter division data as shown on pages 4104-4107 of Composite Catalog, 17th Edition.



Two new midget mechanical drives have a "capsulized" escapement mechanism which can be detached for service or replacement.

Over-all diameters are 3¼ inches and 3 3/16 inches. Both models require only 1 31/32 inches between the plane of the driven chart and the mounting ring.

The larger model (24-3) has an 8-day wind and a basic 24-hour rotation. Patented turrets, which snap on the main arbor, make it possible to vary the rotation speed from 2-hour to 8-day.

The smaller model (24-1) has a 24-hour wind with a torque which drops from 8.6 to 4.7 inch-pounds between full-wind and 24-hour rundown.

Escapements may be bought separately to control the timing of other devices.

For additional information write Pittsburgh Equitable Meter division, Rockwell Manufacturing Company, Pittsburgh 8.

305 — Turbine Pumps

This item supplements Worthington Pump and Machinery Corporation data as shown on pages 5145-5164 of Composite Catalog, 17th Edition.

A new line of vertical turbine pumps is available in capacities from 50 to 15,000 gallons per minute.

The new models develop performance per size and overlapping coverage allows selection of a unit for nearly any capacity and head condition at peak efficiency. Incorporated in the line are extra size bearings of special materials for long life; shaft seals where required; enclosed impellers throughout; wearing rings; flanged and bolted bowl construction.

Either oil or water lubricated pumps are arranged for motor drive, right angle gear drive, or belt drive.

For additional information, write Vertical Turbine Pump Division, 426 Worthington Avenue, Worthington Pump and Machinery Corporation, Harrison, N. J.

306 — Torque Converter Rig

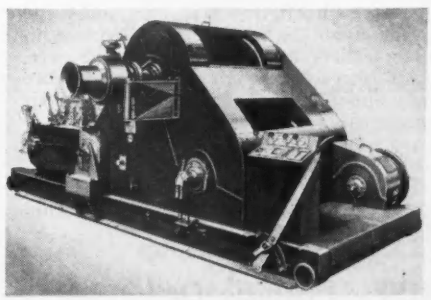
This item supplements Emsco Derrick and Equipment Company data as shown on pages 1437-1556 of Composite Catalog, 17th Edition.

The GA-250-T is a new low-cost 250 horsepower drilling rig designed to meet the specialized requirements of shallow to medium depth drilling or deep workover operations. The rig consists of the engine, torque converter mounted in the drawworks frame, a 2-speed forward and 1-speed reverse selective transmission with friction clutches, cat shaft or sand reel shaft, drum shaft and rotary counter shaft. The drawworks skid is extended to receive the engine and all controls are centralized at the driller's console.

The use of a chain drive between the engine and the torque converter makes it possible to use any make of engine of the proper horsepower capacity regardless of the engine speed.

The GA-250-T is a completely portable unit designed for mounting with a mast on a truck or trailer.

For additional information write Emsco Derrick and Equipment Company, 6811 South Alameda Street, Los Angeles 1.

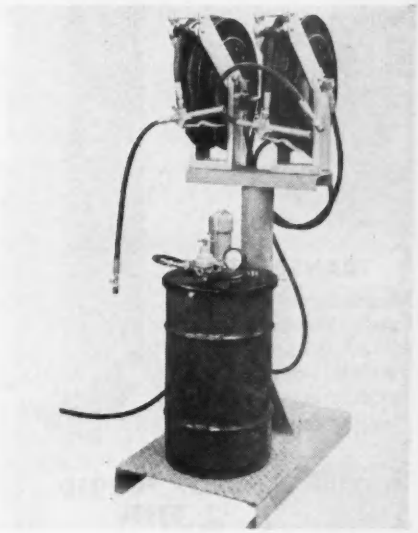


Save Time—Write Direct

As a service to readers, all items in WORLD OIL include the complete mail address of the manufacturer. This makes it possible for those desiring additional information to write any manufacturer without the delay occasioned by going through offices of WORLD OIL, and enables subscribers to request specific data in which they are particularly interested.

307 — Lubrication System

This item supplements Aeroquip Sales & Engineering, Inc., data as shown on pages 166-167 of Composite Catalog, 17th Edition.



A centralized lubrication system now available will bring modern "service station" greasing convenience to drilling rigs, the manufacturer claims.

The new air-pressure greasing system, known as Aeroluber, can be assembled for any type installation and is designed for effective use at any point where there is a concentration of machinery.

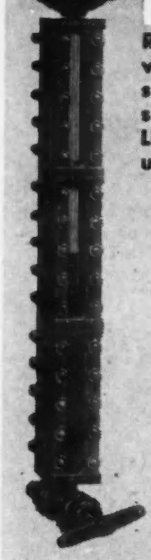
Typical installation for a rotary rig includes 2 spring loaded reels, each with 50 feet of Aeroquip hose, hose fittings, grease fittings and grease control valve with pressure controls to eliminate danger of bursting bearing seals.

To make the system dirt proof and prevent lubrication contamination, the Aeroluber incorporates an Alemite "Atomic" lubricant pump flanged to a drum head that fits any standard 100-pound grease drum. In operation the drum head is fastened to the container and is not removed until it has been completely emptied.

The pump may be located in any convenient place, and the reels mounted on the drawworks header board or to any other portion of the rig where they will not interfere. Any air source affording 80 to 150 pounds pressure can operate the system.

For additional information, write Areoquip Sales & Engineering, Inc., P. O. Box 7043, Fort Worth 11, Texas.

PENBERTHY
Liquid Level GAGES

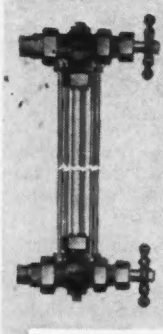


REFLEX

Reflex type complete with gage valves. Liquid shows black—empty space shows white. Liquid level is always unmistakable.

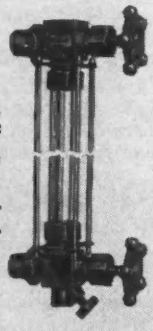
TRANSPARENT

Transparent type complete with gage valves. Used where through vision is desired under high pressures and/or temperatures.



DROP FORGED STEEL

Tubular glass type, Chrome-Moly temperature resisting steel body, stainless steel trim, regrinding removable seats.



ALL IRON

Tubular glass type, extra heavy body of special high strength alloy iron, shanks alloy steel, trim stainless steel, valves self-cleaning.

There is a Penberthy Gage of superior quality for every liquid level gage requirement. Gages are fabricated to customer's specifications from special alloys to meet unusual corrosive and temperature conditions. All Penberthy Gages conform with API-ASME requirements.

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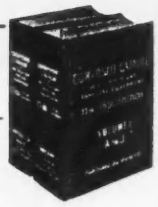
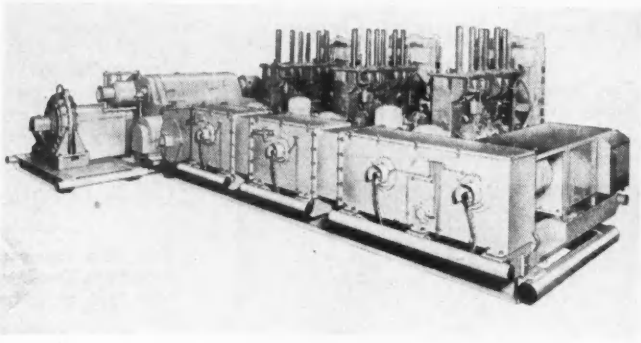


308—Alternate Drive Drilling Rig

This item supplements Wilson Manufacturing Company data as shown on pages 5081-5132 of Composite Catalog, 17th Edition.



Flexibility has been stressed in the design of the new Torcair or Roadair rig, which can be used with either torque converters or direct engine drive. It is available either as a direct driven rig with provision for torque converters to be added later, or with torque converters which can be removed for direct engine drive.

The rig is available with chain-driven rotary table, universal shaft driven table, or with independent table drive unit. The latter unit is available with or without cathead shaft. Engine radiators can be had conventionally mounted in front of engines, or mounted over engines with a bevel gear and V-belt drive to fans to blow air upwards. This saves about 14 inches in length of engine unit.

The 4 air clutch speeds on the drum can be changed while running and under load, if desired.

The unit can be transported in one unit, or broken down into several smaller units where road laws require lesser weights, or lesser widths. The new sectional, box type compound permits removing each engine and compound section as a unit without misaligning engine and compound. A rigid cylindrical housing on each engine skid unit joins the engine flywheel housing (or torque converter) directly to the compound case.

An accessory shaft drive built into the compound case provides drive for air compressors, water pump, thyrite generator, etc., all of which can be located in unused space on rear engine skid.

For additional information, write Wilson Manufacturing Company, Inc., Wichita Falls, Texas.

309—Carbide Drill

This item supplements Reed Roller Bit Company data as shown on pages 4185-4260 of Composite Catalog, 17th Edition.

A new carbide drill for use in the Cleco Handi-Drill is being produced in capacities of ½ to 1 inch, with lengths of 6, 12 and 18 inches available.

The new drills when used with the Handi-Drill will penetrate concrete at the rate of 5 inches per minute, and have been known to drill 500 holes without resharpening, according to the manufacturer.

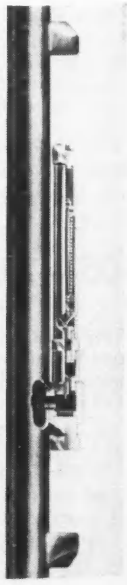
The Handi-Drill is a 9-pound, hand-held drill adaptable to working in close quarters and for all types of masonry work. It operates at a speed of from 1800 to 2000 strokes per minutes, has a ¼ to ¾-inch drill capacity and is 13 inches long without retainer.

For additional information, write Cleco division of Reed Roller Bit Company, P. O. Box 2119, Houston.

310—Gas Lift Valve

This item supplements Merla Tool Corporation data as shown on pages 3273-3275 of Composite Catalog, 17th Edition.

The new Merla Type "L" valve provides efficient gas lift production in continuous flow operations, the manufacturer claims.



Construction consists of a 3-ply seamless Monel bellows, compression spring, valve stem, valve, valve seat and choke. The fluid filled bellows provides protection against bellows damage due to excessive hydrostatic pressures. A compression spring assures a constant operating pressure under extreme temperatures. A choke below the valve seat governs the required gas passage of the valve.

Opening pressure of the valve is a direct line function of the amount of back pressure against the valve. This gives positive assurance that the upper valves in a gas lift string will not open while the lower valves are in operation.

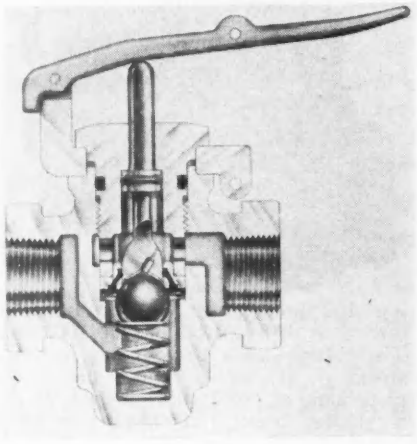
For additional information, write Merla Tool Corporation, P. O. Box 2576, Dallas 1.

311—Shut-Off Valve

This item supplements Page Oil Tools, Inc., data as shown on pages 3965-3970 of Composite Catalog, 17th Edition.

The stem of a new valve is parabolic in shape and incorporates a predetermined fixed orifice which gives a smooth, even increase in flow as the handle is actuated to open the valve. The valve closes with a positive shut-off when the handle is released.

The seat design embodies a triple seal responsive to hydraulic pressures. The rubber is bonded in the seat and communicates through several drilled holes to the inner seal that seals around the stem. Primarily, the outer seal prevents fluid leakage around the outside of the seat. The inside of the same seal prevents leakage around the ball. The third



seal prevents leakage around the stem. When the ball is pushed away from the seat by the stem, the fluid is free to flow around the ball and enters the fluted spaces in the stem and passes on out through the drilled hole. During this course of flow, the fluid pressure is moving the cold flow of rubber to add additional pressure to that part of the rubber sealing around the stem. When the stem is pushed to the wide open position, the fluid then passes around the stem as well as through the drilled hole and the fluid pressure is equalized by that part of the rubber which seals around the ball and the stem.

The bracket which holds the handle swivels with the handle when the plug is loosened, so that any desired handle position can be obtained.

The handle and bracket are drilled and tapped so that a fusible link can be used to hold the valve in a cocked open position where it may be desirable to use a valve of this type for an automatic shut-off in case of fire.

The Type A valve incorporates an "O" ring seal around the stem in the stuffing box area, and the Type B contains a chevron type ring packing.

For additional information, write Page Oil Tools, Inc., 3356 Lime Avenue, Long Beach, Calif.

If You Pump Oil

Make a Note

TO SEND FOR SPECIFICATIONS

ON ALTEN PUMPING UNITS

Alten is more than ever the world's best pumping unit—engineering data, not fancy talk, supports this assertion. A comparison will prove:

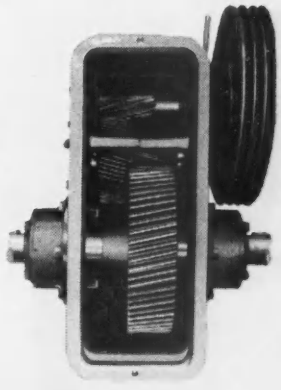
- Alten units give longer strokes and highest gear reducer ratings.
- Alten units will positively perform to their full rated capacities.
- Alten gear reducers give trouble-free operation and have longer life.

Do You Know Why

ALTEN GEARS LAST LONGER?

Alten gears are made from finest alloy steels, precision cut, then shaved for exact tooth profiles and perfect gear operation.

Alten gears are ALTENIZED—an exclusive flame hardening process which gives gear teeth highest surface hardness — your guarantee of longer gear life.



ASK FOR COMPLETE ALTEN LINE
AT YOUR LOCAL SUPPLY STORE

ALTENS FOUNDRY & MACHINE WORKS, INC.
LANCASTER, OHIO

ALTEN

NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

312—Ion Gauge

This item supplements Westinghouse Electric Corporation data as shown on pages 4965-4984 of Composite Catalog, 17th Edition.

Almost complete nothingness can be measured by an electronic pressure-gauge which can detect the presence of air in a vacuum where only one air molecule remains out of every 10,000 billion originally present.

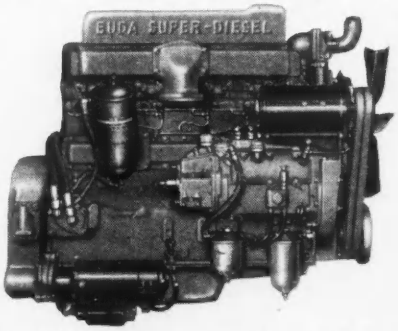
To measure the pressure in a vacuum, the gauge is sealed tight to the system, the power is turned on and electrons from a "gun" inside the gauge are released, as in a radio tube. When these electrons collide with air molecules in their path, they knock off part of the molecule to create an ion. The number of ions formed in this way each second is a measure of the pressure inside the vacuum system.

For additional information, write Westinghouse Electric Corporation, 306 Fourth Avenue, Pittsburgh 30, Penn.

313—Truck Diesel

This item supplements The Buda Company data as shown on pages 890-895 of Composite Catalog, 17th Edition.

A new heavy-duty truck diesel is suitable for operation in all kinds of trucks, buses, and tractors, carrying gross loads up to 52,000 pounds. Model 6-DTS-468 is a supercharged diesel engine develop-



ing 152 horsepower and a maximum torque of 370 foot-pounds at 1600 rpm. The engine has a bore of 4¼ inches, a stroke of 5½ inches, and a piston displacement of 468.3 cubic inches. It is a 6-cylinder model, full diesel, solid injection type.

Over-all length of the unit from the flywheel housing to the front of the fan is 47-9/16 inches; the width at the widest point is 29½ inches. The unit weighs 1418 pounds without electrical equipment and air compressor.

The crankshaft is counterbalanced with 12 counterweights and a torsional vibration dampener on the front end. Engine parts, such as the manifold, the valve covers, brackets and connections are made of aluminum alloy.

The supercharger is belt-driven with step-up gears built into the supercharger for low drive belt speeds. The supercharger is positive displacement type with helical cut gears.

For additional information, write The Buda Company, Harvey, Ill.

Mother Nature Would Be Surprised

Mother Nature used a lot of time and ingenuity putting oil underground; Jensens used the same ingredients perfecting equipment to lift it profitably.

Into each mass-produced Jensen pumping unit has gone more than thirty years design and field experience. Producers swear by it for year-in-year-out, trouble-free service.

See your local Jensen dealer today for complete details—or write us at Coffeyville, Kansas. We can help you in your "battle" with Mother Nature.

JENSEN

Bros. Mfg. Co., Coffeyville, Kan.

Export Office: 50 CHURCH STREET, NEW YORK CITY

Save Time—Write Direct

As a service to readers, all items in WORLD OIL include the complete mail address of the manufacturer. This makes it possible for those desiring additional information to write any manufacturer without the delay occasioned by going through offices of WORLD OIL, and enables subscribers to request specific data in which they are particularly interested.

7/8 in. Rods in 2 in. Tubing?

It's both easy and practical to use 7/8 in. sucker rods in 2 in. tubing when you choose Bethlehem stock rods and the Bethlehem Maxiflow Coupling.

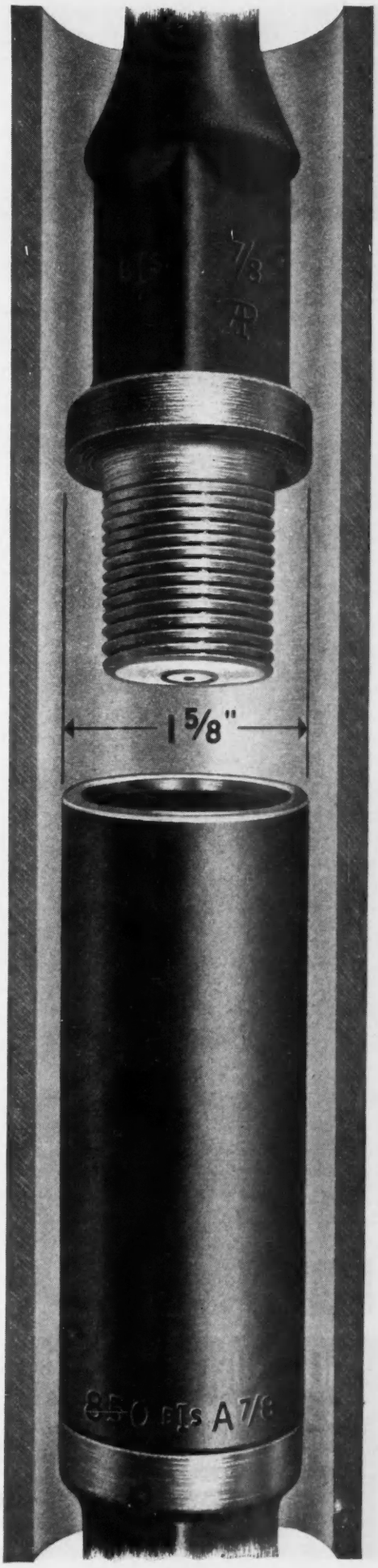
This useful combination provides a full-strength joint. The pin is full size. The coupling is 1 5/8 in. in diameter, and is tapped for 7/8 in. pins. The Maxiflow Coupling is amply strong because it is made of specially treated steel, and is furnished in full section, without wrench flats. This permits the use of a standard overshot in 2 in. tubing.

Full details about the use of the Maxiflow Coupling are available from the nearest Bethlehem sales office or sucker rod distributor. Or, if you prefer, get in touch with us at Bethlehem, Pa.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

BETHLEHEM *Sucker Rods*

BETHLEHEM STEEL



INSWELL
DOUBLE-DUTY STEEL CHAIN

WHAT DO YOU ASK FOR IN CHAIN?

SAFETY to men and materials?

LONG SERVICE LIFE under exposure to abrasion and weather?

ECONOMY in first cost or "services rendered?"

EASE OF HANDLING by reason of non-kinking, short link design?

● **SPECIFY INSWELL**

Double-Duty High Test Chain and you have *all* of these advantages working for you. Our best customers are those who gave Double-Duty Chain the "on-the-job" test.

WRITE US *for the name of the distributor nearest your office or field operations.*

COLUMBUS McKINNON CHAIN CORPORATION

(Affiliated with Chisholm-Moore Hoist Corp.)

GENERAL OFFICES AND FACTORIES: TONAWANDA, N. Y.

SALES OFFICES: New York • Chicago Cleveland • San Francisco

Other Factories at Angola, New York, St. Catharines, Ontario and Johannesburg, S. A.

NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

314—Multiplex Terminal for Radio System

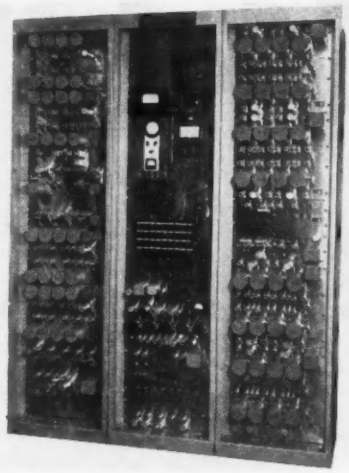
This item supplements Philco Corporation data as shown on page 4102 of Composite Catalog, 17th Edition.

Communications channelizing of the time-division type for use with microwave radio relay systems employs pulse amplitude modulation (P.A.M.). The Philco CMT-4 multiplex terminals are available in various models to provide 4, 8, 12, 16, 24, or 32 voice channels.

Pulse amplitude modulation time-division multiplexing has an economy of bandwidth and is free from crosstalk of time-division systems. It has a spectrum economy normally associated with commercial telephone carrier systems. The composite output of a 32-channel P.A.M. multiplex terminal is less than 300 kilocycles wide.

The system has the ability to drop out one or more channels at repeater stations. It is possible to employ "party-line" techniques with it, making this system particularly adaptable to pipe line operations. Individual voice channels may also be subdivided to provide a number of telegraph, telemeter or remote control circuits.

For additional information, write Philco Corporation, 445 E. Tioga Street, Philadelphia 34, Penn.



EACH WAY-EVERY DAY
DAILY Flights to
VENEZUELA and JAMAICA!

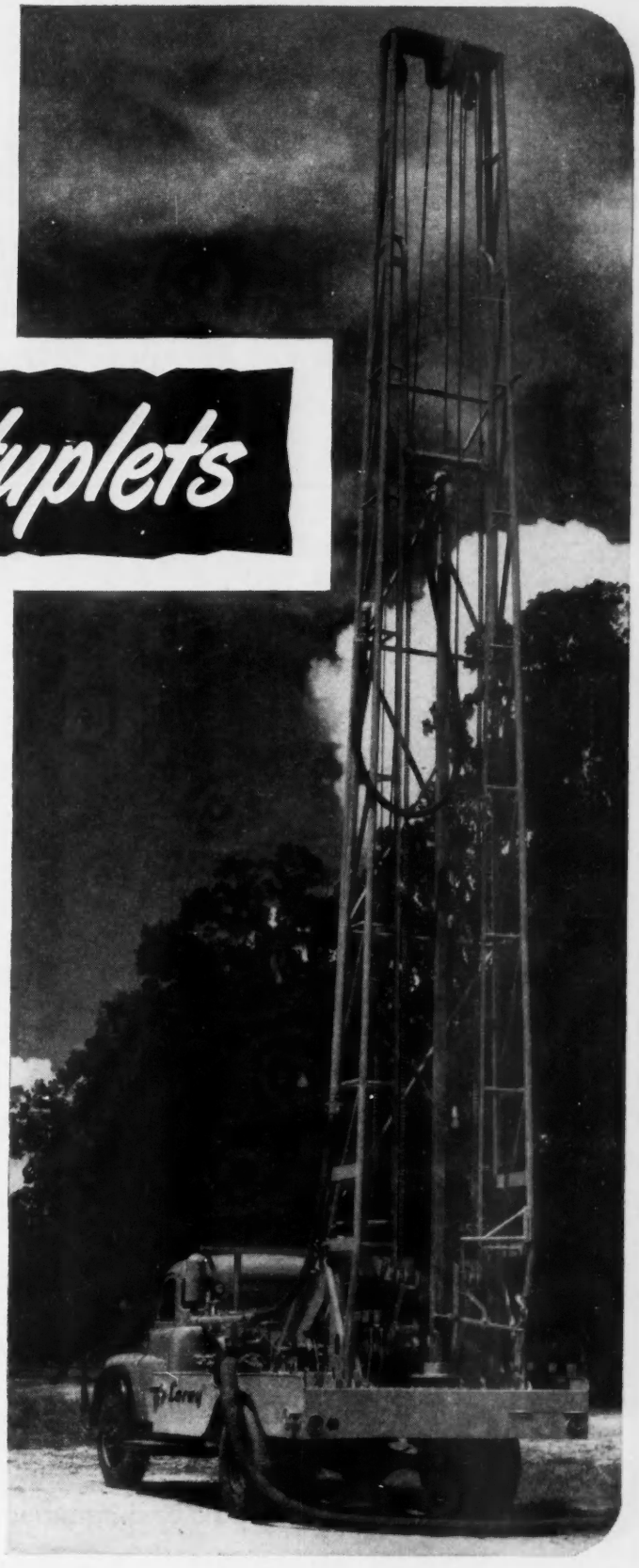
Chicago & Southern Air Lines' fleet of 4-motored Douglas Skymasters now offers seven-days-a-week service through the Houston and New Orleans gateways to Caracas, Kingston, and Havana. Flights each way every day provide one-plane service from the Great Lakes to the Venezuelan oil capital. Ask your travel agent or nearest C&S ticket office.

CHICAGO & SOUTHERN AIR LINES

General Offices, Memphis, Tenn., U.S.A.

C&S

The Carey *Quintuplets*



Careys Machine Company, Houston, uses *FIVE* Twin Disc Clutches on its new Model 3 Drill—three oil-type Model MT Clutches in the power transfer case and two Model CL units to drive the drawworks.

Designed for shot-hole, core-hole and water-well drilling, the new Carey drill is rated at 1500 feet. Smooth-operating, long-wearing clutches are a "must" on rigs like this. In Twin Disc Clutches these characteristics are "built-in."

That's why Twin Disc Clutches . . . also famous for simple adjustment, fast action, easy engagement . . . are standard equipment on leading rigs. For complete information write for Bulletin 120-C.

Careys Machine Company's Model 3 Drill . . . Twin Disc Clutch-equipped for high wear-life under rapid-cycle operation.

TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES

Clutches & Hydraulic Drives

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin • HYDRAULIC DIVISION, Rockford, Illinois

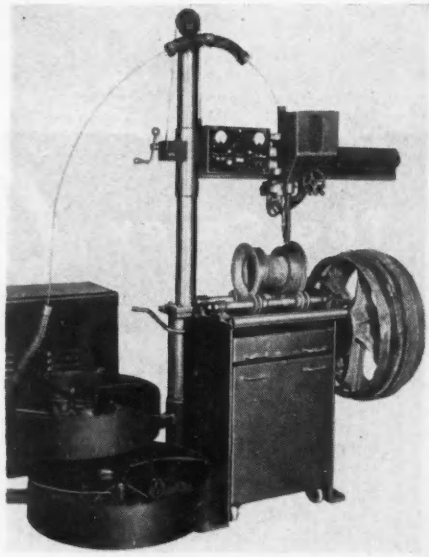
BRANCHES: CLEVELAND • DALLAS • DETROIT • LOS ANGELES • NEWARK • NEW ORLEANS • SEATTLE • TULSA

OTHER NEW AND IMPROVED EQUIPMENT

315—Welding Machine

A unitized welding machine for production welding and hard-facing, known as the "Leader," incorporates a 500-amp AC welder, an automatic welding head and a positioner with accommodations for both horizontal and angular mounting of the work.

The AC power supply contains 2 windings—the heavy duty side supplies the automatic head with variable heats of from 100 to 500 amps. A separate stinger winding of 120 amps capacity is available for tack welding operations. The head handles all sizes and types of automatic wires and has provisions for manual step-over control for spacing weld beads as well as horizontal travel along its supporting arm. If submerged arc operation is required flux is supplied from an attached hopper.



For additional information, write Leader Welding and Manufacturing Company, 2418 Sixth Street, Berkeley, Calif.

316—Dual Fuel Engine

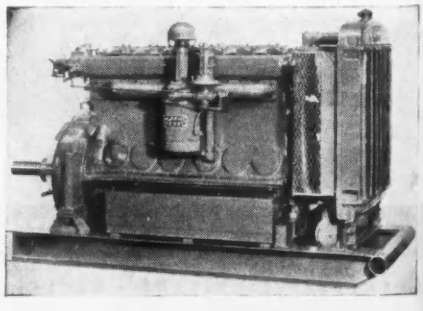
A new line of heavy-duty engines, power units and generator sets capable of burning either natural gas or diesel fuel employ the same basic construction as Murphy diesel engines. The new dual-fuel engines permit operation on either fuel by positioning a simple lever for the desired fuel. On either fuel no further adjustments are necessary.

Gas is fed to the engine through the air cleaner and intake manifold at substantially zero pressure. The vacuum of the engine delivers a full charge of air every intake stroke and the hydraulic governor controlled gas valve admits the correct amount of gas to deliver the horsepower required.

Ignition is accomplished by injecting pilot diesel fuel into the cylinder. The heat of compression ignites the gas-air mixture.

Three models are available, ranging from 135 to 180 horsepower.

For additional information, write Murphy Diesel Company, 5315 West Burnham Street, Milwaukee 14.



THE FIRST NATIONAL BANK

MIDLAND, TEXAS

SOUND—DEPENDABLE—SAFE BANKING

For Over Sixty Years

Capital Investment over ..... **$ 1,500,000.00**

Resources over **$27,500,000.00**

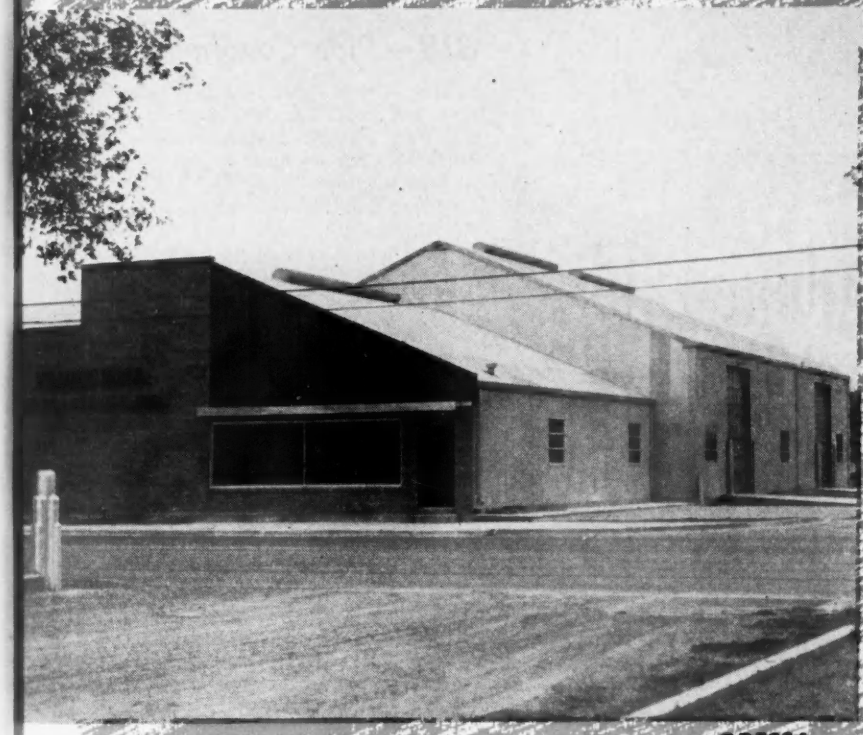
Efficient and Complete Banking Service to members of the Oil Fraternity and to all individuals and commercial interests. Oil collections handled promptly under official supervision.

THE FIRST TAKES PRIDE IN SERVING WELL

NOW FOUR Waukesha STORES TO SERVE WEST TEXAS

HOBBS

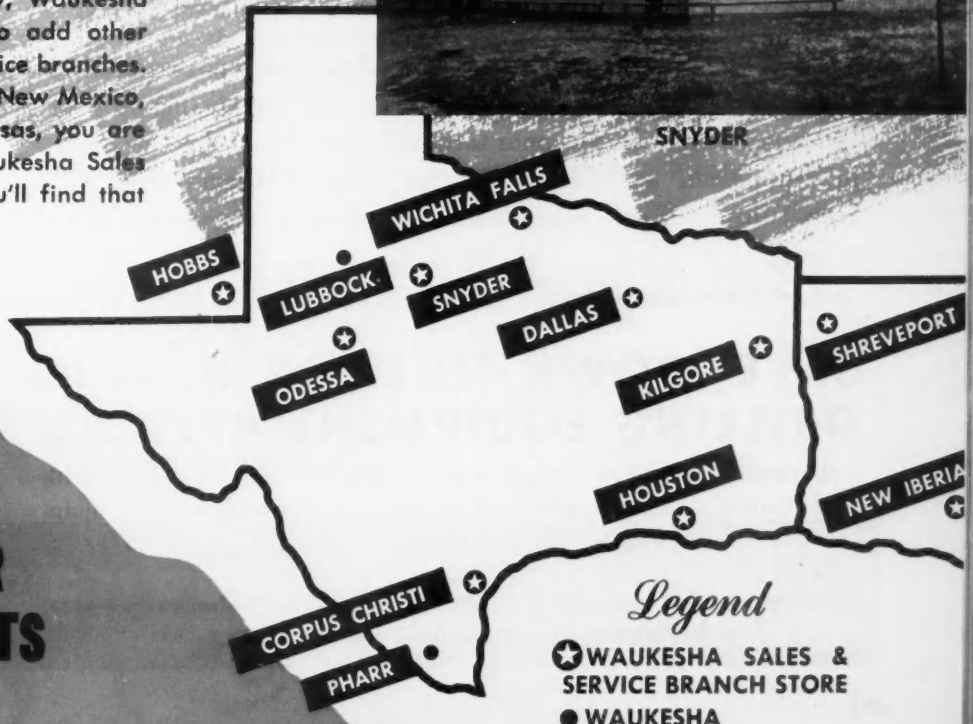
WICHITA FALLS



ODESSA

SNYDER

As other areas increase in activity, Waukesha Sales and Service will be there to add other links in its network of sales and service branches. So if your operations are in Eastern New Mexico, Texas, Louisiana or Southern Arkansas, you are just around the corner from a Waukesha Sales and Service Branch. Call them. You'll find that the accent is on service.



WAUKESHA

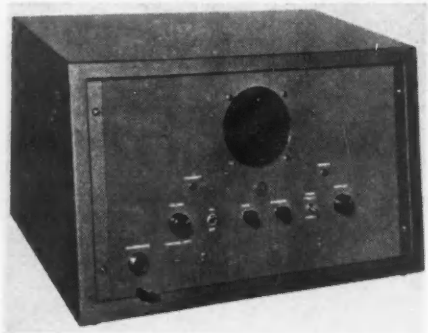
SALES & SERVICE, INC.

1422 MAURY ST., HOUSTON

DISTRIBUTORS FOR WAUKESHA PRODUCTS

IN TEXAS, LOUISIANA AND EASTERN NEW MEXICO

317—Remote Control Unit



A new remote control consolette for use with mobile radio communications systems can be incorporated into all mobile systems operating in the 30-50-mc or 152-174-mc frequency bands.

The consolette, RCA Type CC-4C, consists of a limiting amplifier, power supply, audio amplifier, loudspeaker, and complete set of controls. Operating over a single pair of telephone wires, it controls a remote rack-mounted receiver and transmitter by a system of relays.

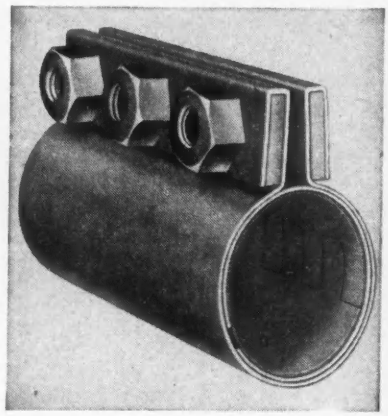
The console is built of welded steel. A loudspeaker which operates from the receiver output is mounted behind the front panel. It is provided with volume, tone, intercom, and squelch controls, and pilot lights which indicate when transmitter carrier and receiver power is on.

For additional information, write Mobile Communications Section, Radio Corporation of America, Camden, N. J.

318—Pipe Couplings

Morris pipe couplings are now available for pipe sizes up to 8 inches. In addition to the standard zinc coated steel line, all aluminum couplings are available in all sizes to 8 inches.

The couplings are used for permanently joining either plain end or threaded



pipe or a combination of the two. The pipe coupling is a compression band type coupling and holds the entire surface of the joint in compression. The coupling is applied with a socket or crescent wrench.

For additional information, write Morris Coupling and Clamp Company, 1379 Beaver Avenue, Ellwood City, Penn.

319—Metering Element

The Foster "Flow Tube," a new primary element for the measurement and control of fluid flow, is essentially a differential producer which can be used with properly calibrated conventional recording, indicating, integrating, or control instruments.

The device consists of a short spool piece with an inner sleeve equipped with 2 groups of pressure nozzles, 1 set pointing upstream and the other downstream. These nozzle groups are interconnected by common pressure rings from which connections are made to the meter.

Flow tubes are made in 3 fundamental types and in all standard pipe sizes.

For additional information write for Bulletin FT, Foster Engineering Company, 835 Lehigh Avenue, Union, N. J.

"A COMPLETE PACKAGE"
BY
Levingston

From crown block to barge bottom, Levingston is prepared to accept the entire responsibility of constructing and rigging-up your submersible drill barges on a turn-key basis. You select the tools, or equipment, and Levingston's experienced organization will install them for safe and efficient operation on marine locations.

Levingston SHIPBUILDING CO. • ORANGE, TEXAS

SAVE "DOWN TIME" ON MARINE DRILLING EQUIPMENT REPAIRS

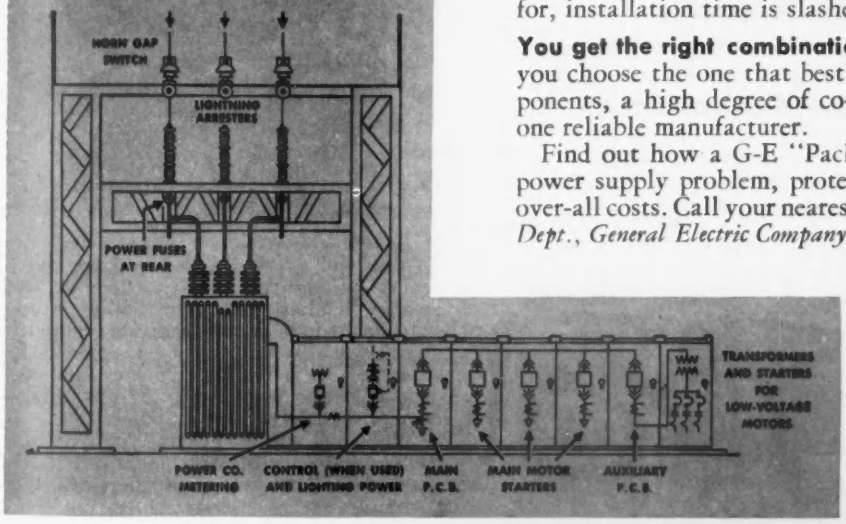
Levingston know-how and dry dock facilities provides the industry with a conveniently located repair yard for all types of marine drilling equipment . . . from LST's to drill barges to oil barges.

Day Phone: 8-3521; Night Phones: L. J. Vincent, Repair Superintendent, Phone 8-4516; George Duchamp, Ass't. Repair Superintendent, Phone 8-4841.

Pipeline power distribution—
ALL YOU NEED IN ONE COST-SAVING PACKAGE!

Typical of the neat appearance and compact arrangement of G-E "Package" substations is this Texas pipeline-station installation. This one unit makes available 115-230-, 480-, and 2400-volt power covering all motor and lighting requirements.

What's in the "Package?" It comprises a complete outdoor steel switching structure—plus a master unit substation. The switching structure may include lightning arresters, disconnecting switches, buses and bus supports, potential transformers and current transformers, relaying and metering equipment, and outdoor oil circuit breakers (or fuses). The unit substation includes transformers and in the switchgear section, motor starters. Ratings are from 750 to 45,000 kva, at incoming voltages from 11 to 69 kv and outgoing voltages up to 13.8 kv.



This one cost-saver—a General Electric "Package" substation—combines *all* the electric equipment your pipeline station needs between incoming utility lines and all motor and lighting circuits. Ordered, designed, and built as a single unit, it comes complete, co-ordinated, ready-to-install.

You reduce system cost Because you don't have to order the components piecemeal, you save engineering cost, as well as time and trouble. And because the entire unit arrives in large, factory-built sections, installation expense is less.

You save time Less drafting and manufacturing time is needed because the over-all design is already largely complete, and the components are in stock or can be built repetitively. With no bottleneck parts to wait for, installation time is slashed.

You get the right combination From scores of standard combinations, you choose the one that best fits your needs. You get the finest of components, a high degree of co-ordination, and responsibility centered on one reliable manufacturer.

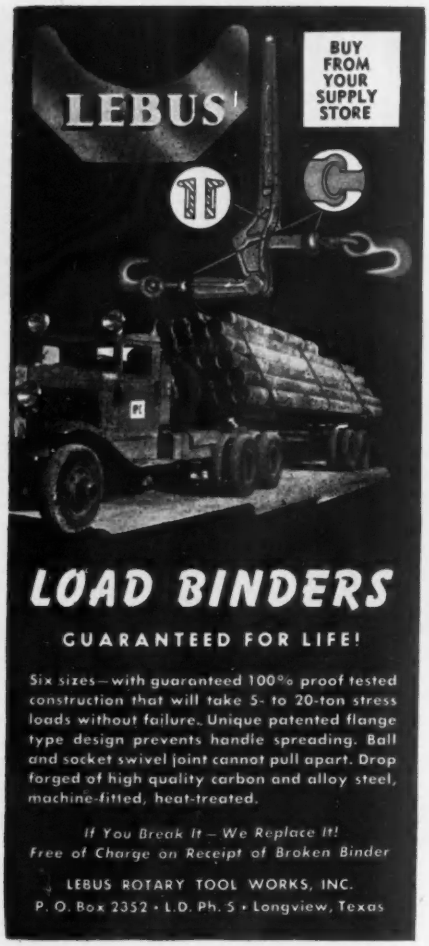
Find out how a G-E "Package" substation can solve your pipeline's power supply problem, protect your continuity of operations, help cut over-all costs. Call your nearest G-E office for more information. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

Power supply for pipeline stations is one of many subjects vividly shown in "Lease on the Future," General Electric's "More Power to America" full-color and sound movie on oil field electrification. Ask your nearest G-E office to arrange a showing for you.

Everything you need to cut oil pipeline costs —electrically!

GENERAL ELECTRIC

661-16



LOAD BINDERS

GUARANTEED FOR LIFE!

Six sizes—with guaranteed 100% proof tested construction that will take 5- to 20-ton stress loads without failure. Unique patented flange type design prevents handle spreading. Ball and socket swivel joint cannot pull apart. Drop forged of high quality carbon and alloy steel, machine-fitted, heat-treated.

If You Break It — We Replace It!
Free of Charge on Receipt of Broken Binder

LEBUS ROTARY TOOL WORKS, INC.
P. O. Box 2352 • L.D. Ph. 5 • Longview, Texas

Complete
PETROLEUM ENGINEERING SERVICE

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SERVICE
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MIDLAND, TEXAS

OTHER NEW EQUIPMENT

320—Resistance Tester

A light, rugged, instrument for measuring soil, anode and circuit resistances, and polarization effects, Vibroground Model 263 weighs 9½ pounds, ready to operate with cover removed, and 10½ pounds with cover.

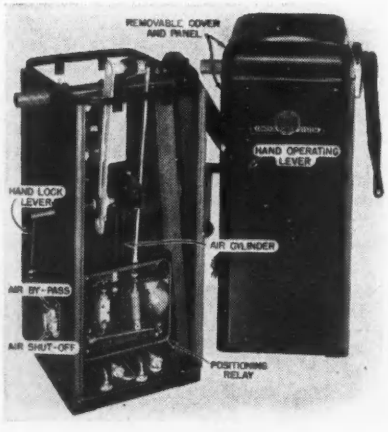
Resistance ranges are 0-1, 0-10, 0-100, 0-1000 ohms. Power is provided by 8 standard flashlight batteries, with a circuit incorporating a synchronous self-rectifying vibrator having an output of 125 volts. Resistance measurements can be made by the 2-, 3-, or 4-electrode methods.

Ranges are selected by a separate switch at lower left of the panel. Direct readings are shown on the single scale of the potentiometer. All resistance values are determined by decimal multiplication.

For additional information, write Associated Research, Inc., 3758 West Belmont Avenue, Chicago 18.

321—Control Drive

A new completely enclosed air-operated characterized control drive makes it possible to parallel characteristics of a driven device with characteristics of other equipment thereby securing a unified system. The Bailey Control Drive consists of a double acting air cylinder (with rigid supporting stand and enclosure) a positioning relay, and a manual operating wheel or lever.

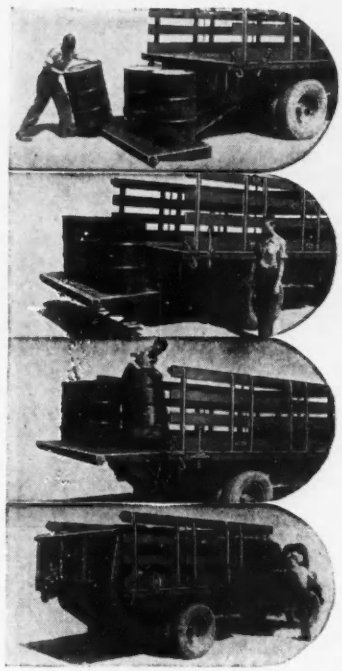


The positioning relay incorporates a cam whose shape determines the relation of control drive position to control loading pressure. Three cams may be used interchangeably to obtain positions which are proportional to the first power (straight line), square, or square root of the control loading pressure.

The drives are furnished in 2 sizes—one sizes has a 6 x 8-inch cylinder (6-inch bore and 8-inch stroke) for torque requirements of 280 to 400 foot-pounds and the other has an 8 x 16-inch cylinder for requirements up to 1500 foot pounds.

For additional information, write Bailey Meter Company, 1050 Ivanhoe Road, Cleveland 10.

322—Hydraulic Gate



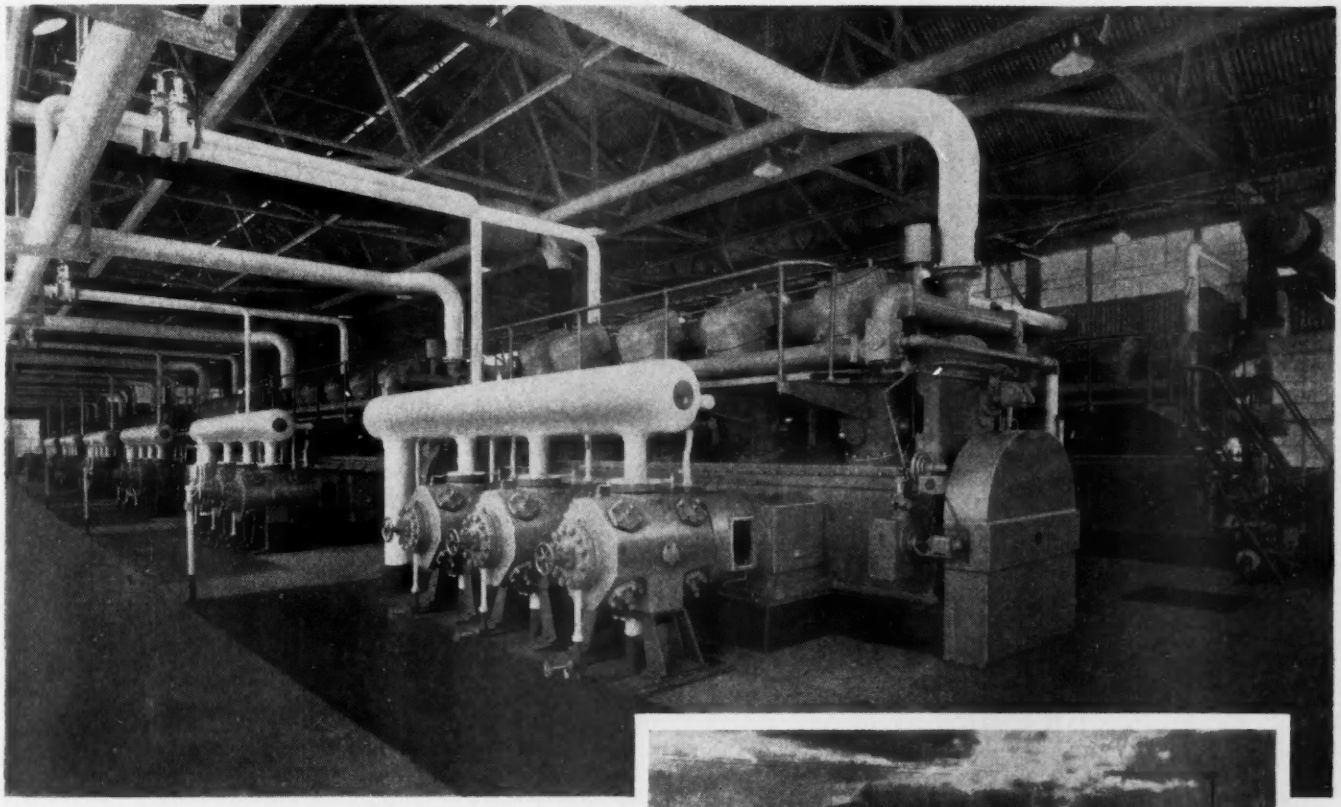
The Cobey Hydra-Power End Gate, combination hydraulic lift end gate for trucks hauling heavy or bulky cargo, can be installed on any make or model truck with suitable body type, and is operated from the truck power take-off. Closing as well as lifting the gate is accomplished by hydraulic power.

The steel and wood box-type gate has a load capacity of 3000 pounds. It may be stopped at any point between the ground and truck floor. Operating controls are at the rear of the truck platform, and can be operated from the ground by hand or from the gate itself, either by foot or hand. Controls for operation from truck cab are also available.

For additional information, write The Perfection Steel Body Company, Galion, Ohio.

20,000 HORSEPOWER

INGERSOLL-RAND KVG GAS-ENGINE COMPRESSORS



for El Paso Natural Gas Company's Guadalupe Station

It takes a lot of horsepower to move 330 million cubic feet of gas from Texas to California. Here in the Guadalupe Station alone (one of 6 compressor stations on the El Paso Natural Gas Line), there is a total of twenty, 1000-hp compressors—all Ingersoll-Rand KVG gas-engine-driven units. Fourteen of them, shown above, are located in the main compressor plant, and six more (on the loop) are in an adjacent building. And 5 additional, similar units will be installed here in the near future.

In applications like this, dependability is a most important requirement . . . as are economy of operation and ease of maintenance. That's why Ingersoll-Rand KVG gas-engine-driven compressors are first choice with so many gas-line operators and maintenance men. They know, from experience, that these compact, rugged and powerful units can always be depended on to stay on the job, 24 hours a day, year after year, with minimum attention. And their 4-cycle, V-angle design permits maximum operating efficiency.

Whatever your compressor requirements, your nearest I-R representative is qualified to give you expert guidance . . . to help you select the equipment best suited to your needs.

4 CYCLE V

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 505-6

COMPRESSORS · AIR TOOLS · ROCK DRILLS · TURBO BLOWERS · CONDENSERS · CENTRIFUGAL PUMPS · OIL & GAS ENGINES

323—Unions and Valves

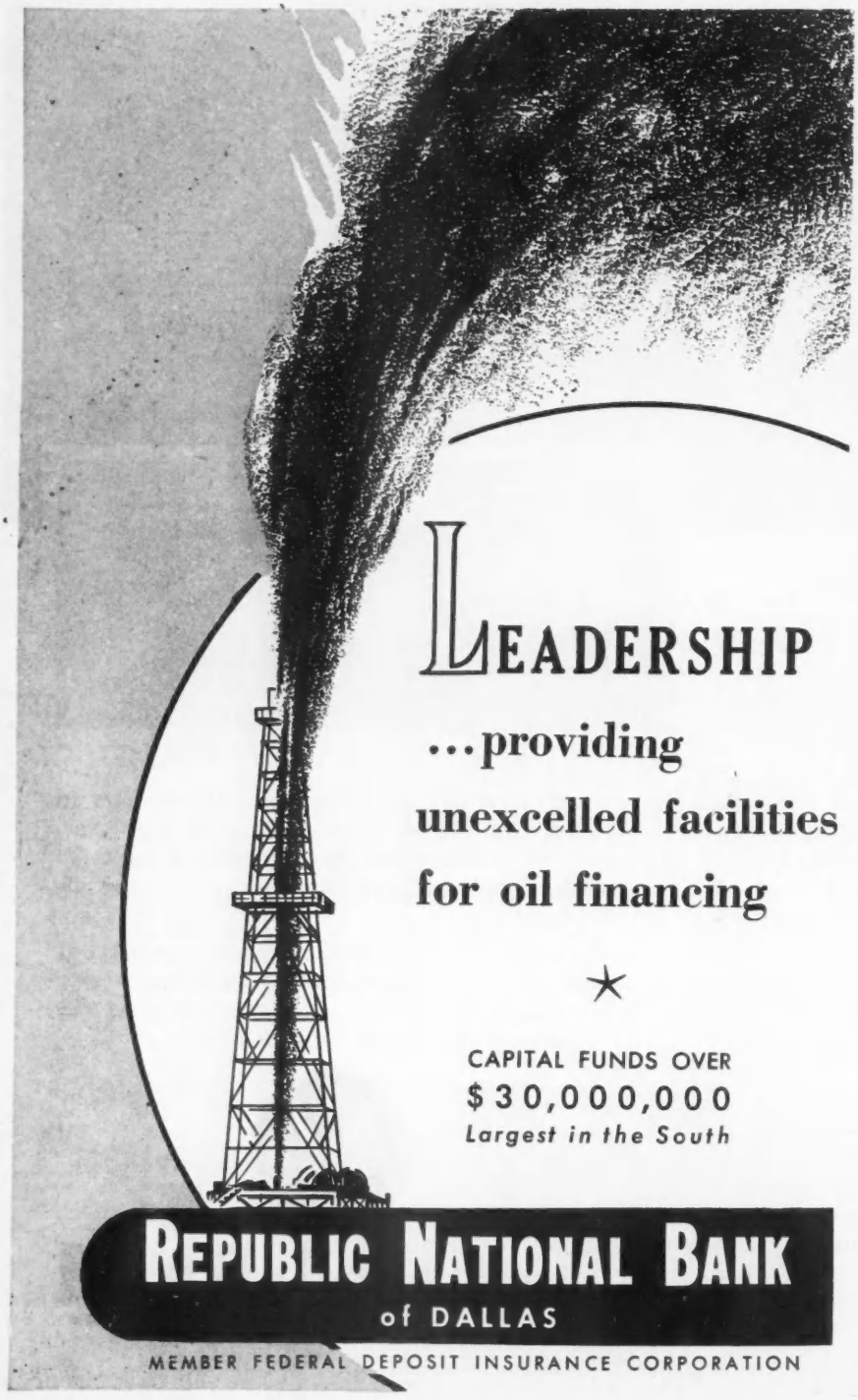
Catalog 11 illustrates a complete line of hot forged steel unions and valves and contains data, specifications and prices. It pictures both standard and double extra heavy hot forged steel unions, as well as orifice, male and female, lug nut, and stainless steel and full alloy steel unions. Illustrated also are single union swing check and spring controlled check valves, as well as the company's double union full opening swing check valve.

For a copy of this catalog, write Catawissa Valve & Fittings Company, Catawissa, Penn.

324—Regulating Valve

A new 12-page, 2-color illustrated bulletin covers the company's complete line of low-pressure regulating valves, giving full specifications and selection data on valves, valve accessories, and pressure master controls.

For a copy of Bulletin S-22-C write Swartwout Company, 18511 Euclid Avenue, Cleveland 12.



325—Gas Lift

A 173-page catalog contains a 48-page discussion of techniques of gas lift production methods and lifting principles. Gas lift valves, surface controllers, packers and accessory equipment are shown in labeled cutaway drawings with information on the construction, operation and use. A data section contains 39 pages of engineering graphs and tables. Unit prices and parts prices are itemized.

For a copy of Catalog 650 write Merla Tool Corporation, P. O. Box 2576, Dallas 1.

326—Hard Facing

A new 40-page hard-facing manual describes the selection of the right alloy, choice of the welding process, and method of applying various rods by both the oxy-acetylene and metallic-arc welding processes. Information is given on the properties and available sizes of 12 Haynes hard-facing materials.

For a copy of this manual write the Haynes Stellite Division, Union Carbide and Carbon Corporation, 725 South Lindsay Street, Kokomo, Ind.

327—Auxiliary Unit

The Ideal Type B portable auxiliary unit, with diesel or gas engine drive, 20 KW, DC or AC generator set, air compressor and receivers, and water pump, is presented in a new 4-page, 2-color illustrated bulletin. Complete specifications and line drawings showing a unit cross section and floor plan are included.

For a copy of Bulletin I-365 write The National Supply Company, Box 899A, Toledo.

328—Drilling Rigs

A new 12-page, 2-color illustrated bulletin covers the Joy 200 Series rotary rigs, giving drill specifications, information on power combinations for various drilling conditions, and a chart for the selection of the right drill to meet individual drilling requirements.

For a copy of Bulletin RM-703 write Joy Manufacturing Company, Henry W. Oliver Building, Pittsburgh 22.

329—Pumping Unit

A new catalog describes the principle of the Lacy air balanced pumping unit. It contains installation photographs and gives operating characteristics.

For a copy of this catalog write Lacy Oil Tool Company, 973 North Main Street, Los Angeles 12.

Correction:

In the June, 1950, "New Literature" section of WORLD OIL, Item 230 should have been entitled "Junk Catcher." The equipment incorrectly termed a "Junk Snatcher" is the Junk Catcher manufactured by Globe Oil Tools Company, Los Nietos, Calif.

. . . the only Disc Clutch

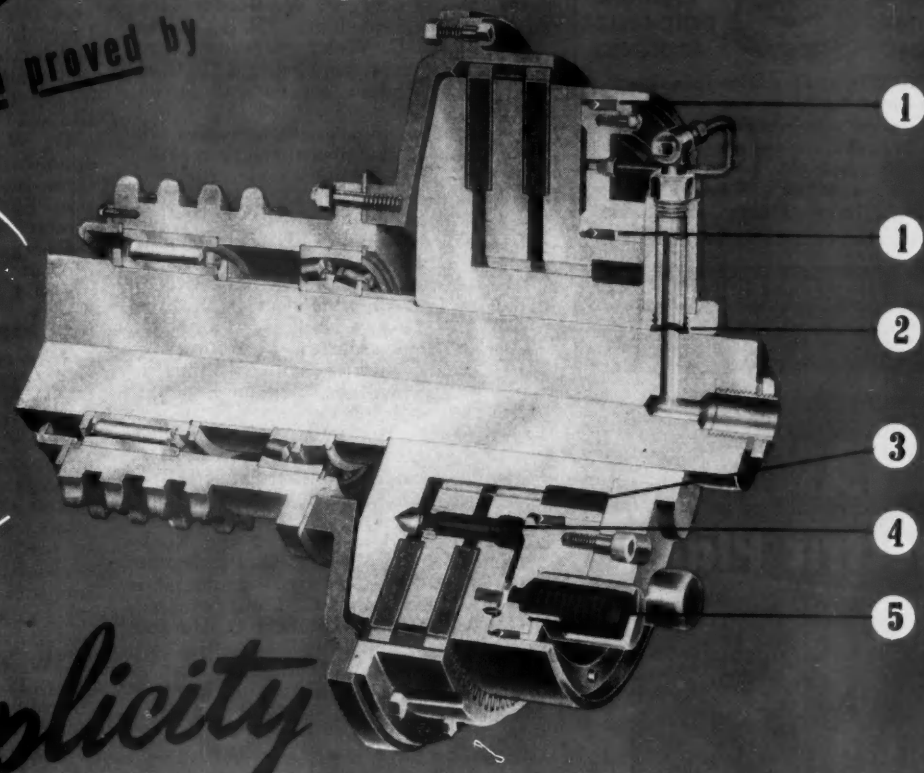
with **POSITIVE RELEASE**

Air-Tite

Dual Seal Disc Clutch

6 years drilling service

Field proved by



100% performance on pump drives

Simplicity

Ideco *Air-Tite* Clutches have only one actuating part. Engagement is made smoothly without double clutching. Positive separation of all friction elements permits blocks to fall freely . . . eliminates wear when idling. No adjustment is ever required as the Ideco *Air-Tite* Clutch is self-compensating for wear. Rugged heavy-duty construction assures long service-free operation.

COMPARE THESE FEATURES:

1. **Double External Air-Tite Packing** — *"O" Ring and "V" Packing can be replaced quickly in the field with clutch in place.*
2. **Sealed Air Take-Off** — *A permanent air seal between shaft and hub.*
3. **Full Complement of Teeth** — *Has 360° full contact.*
4. **Patented Release Pins** — *Provides a positive separation between floating plate and friction plates.*
5. **External Release Springs** — *Releasing action is quick and positive, unaffected by heat, corrosion or centrifugal force. This design provides high clutch capacity within a small diameter.*

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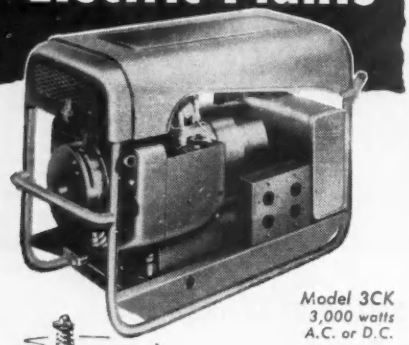

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● ONAN oilfield electric plants provide dependable light and power for oil field applications. A complete range of A.C. and D.C. models... all conservatively rated for continuous, dependable service helps you choose the right plant for the job. Lightweight, air-cooled models from 400 to 5,000 watts; heavy-duty, water-cooled, gas-gasoline-driven plants from 3,000 to 75,000 watts. Air-cooled Diesel electric plants 2,500 and 5,000 watts. Water-cooled Diesels from 12,500 to 75,000 watts, powered by IH engines.

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Men in the Industry NEWS

W. C. Whaley, director and vice president in charge of Sunray Oil Corporation's California division, has been placed in charge of the company's West Coast operations with headquarters in Los Angeles. Supervising personnel includes **F. A. Fueller,** manager, Land department; **J. S. Loofbourow, Jr.,** manager, Geological department; **T. J. Casey,** counsel, and **R. A. Smith,** attorney, legal department; **H. L. Stine,** Sunray assistant secretary, office manager; **G. W. Davis,** chief accountant.

Production operations will be directed by **R. E. Foss,** with the following field supervision: **O. A. Graybeal,** reservoir engineer; **T. J. Prehoda,** drilling superintendent; **D. L. Caldwell,** drilling department engineer; **F. W. Borden,** production superintendent; **T. H. Acres,** engineer; **M. C. Welch,** superintendent, gas and gasoline department; **E. B. Closson,** superintendent, mechanical department.

Exploration department activities will be supervised at Tulsa through creation of 3 operating divisions under the general direction of **Don O. Chapell,** vice president and manager of Exploration and Land department. **E. A. Markley,** formerly chief geologist for Barnsdall Oil Company will be senior division geologist and supervisor of exploration for West Texas, Abilene and North Texas districts; **Marion J. Moore,** formerly Sunray district geologist, San Antonio, Texas, will be division geologist and supervisor of exploration for the South Texas, Texas Gulf Coast, Louisiana and Mississippi districts; **Sherril A. Shannon,** formerly Sunray district geologist, Wichita, Kansas, will be division geologist and supervisor of exploration for Kansas, Oklahoma and the Rocky Mountain states. **Harold G. Picklesimer** succeeds Moore as district geologist in San Antonio; **Ralph C. Lamb** succeeds Shannon in Kansas. **Robert O. Burkett,** geologist in Sunray's Tulsa office, has been transferred to Midland, Texas, as district office geologist, and **Karl F. Martin, Jr.,** formerly in the Tulsa office, is scout at Midland.

•

W. O. Keller has resigned as reservoir engineering supervisor, Stanolind Oil and Gas Company, Tulsa, and is affiliated with the newly-organized firm of Keller and Peterson, Midland, Texas. Keller joined Stanolind in 1941 upon his graduation from Texas A. and M. College. He spent several years in field engineering work in East and West Texas with later assignments including proration and reservoir engineering in Stanolind's Fort Worth division. In 1946 Keller was transferred to Tulsa in charge of all reservoir engineering. Keller also becomes associated with McMillan, Keller and Peterson, Midland, a new firm dealing in oil properties.

W. O. Keller

D. W. Sims

W. L. Kygar

W. L. Kygar, Ponca City, Okla., has been elected president of Continental Pipe Line Company, which has approximately 2000 miles of pipe lines and gathering systems in Oklahoma, Texas, Louisiana, New Mexico, Kansas, Indiana, Wyoming, and Montana.

D. W. Sims, Ponca City, has been appointed manager of Continental Oil Company's Motor Transportation division. Sims assumes operations formerly directed by Kygar.

George W. Evans, Houston, manager of Continental Oil Company's Transportation and Purchasing departments, has been elected chairman of the board of the pipe line company.

A. C. Wilkinson, Ponca City, continues as vice president and manager of Continental Pipe Line Company. **John Kelly,** formerly motor transportation engineer, has been promoted to assistant manager.

Kygar, who has been with Continental Oil Company for more than 25 years, was formerly assistant manager of the company's motor transportation division, but spent many years in pipe line and production operations.

•

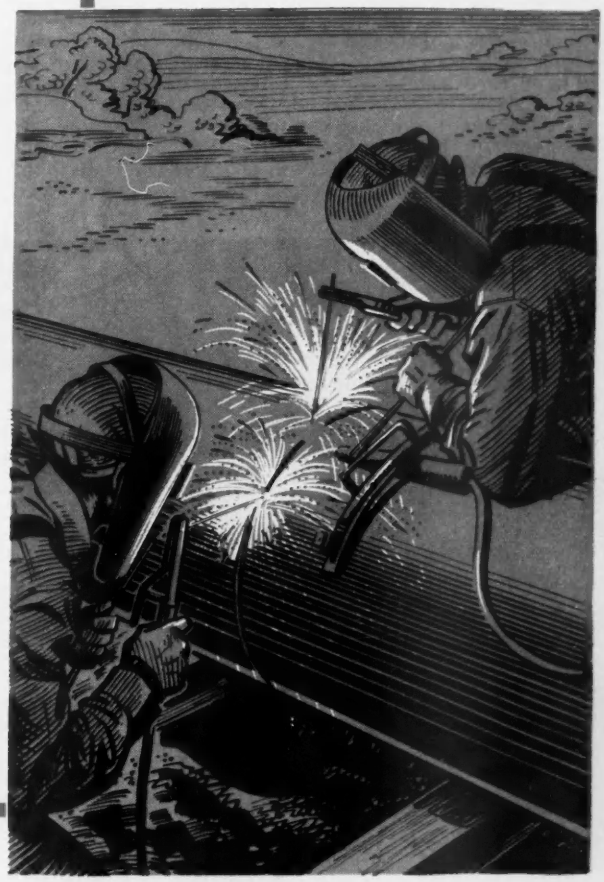
N. W. Freeman, assistant to the president, **R. L. McVey,** controller, **Harold Burrow,** manager of Gas Supply department, and **Louis Sonnen,** manager of the Purchasing department, have been elected vice presidents of Tennessee Gas Transmission Company.

All are veteran executives with TGT. Freeman joined the company as manager of the personnel department in 1943 and became assistant to the president in 1947. McVey started as assistant to vice president in 1945 and became controller in 1947. Burrow was first purchasing agent, then director of purchasing, and in early 1949 manager of the Gas Supply department. Sonnen also began with the purchasing department in 1943 and was made manager in early 1949.

•

Richard A. Shelly, petroleum geologist, Bay Petroleum Corporation, has been made manager of the Kansas division succeeding **Clifton L. McCowan** who has become an independent geologist. **Don L. Hellarm,** formerly on Sohio Petroleum Company's geological staff, has joined Bay's Wichita, Kansas, office; **John O. Allen** has been transferred to the title division at Denver.

Why the *FIRST* names in pipelines depend on the *FIRST** name in line pipe



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A. O. Smith Line Pipe is available in a complete range of sizes and wall thicknesses, from 8⅝ in. to 36 in. in diameter.

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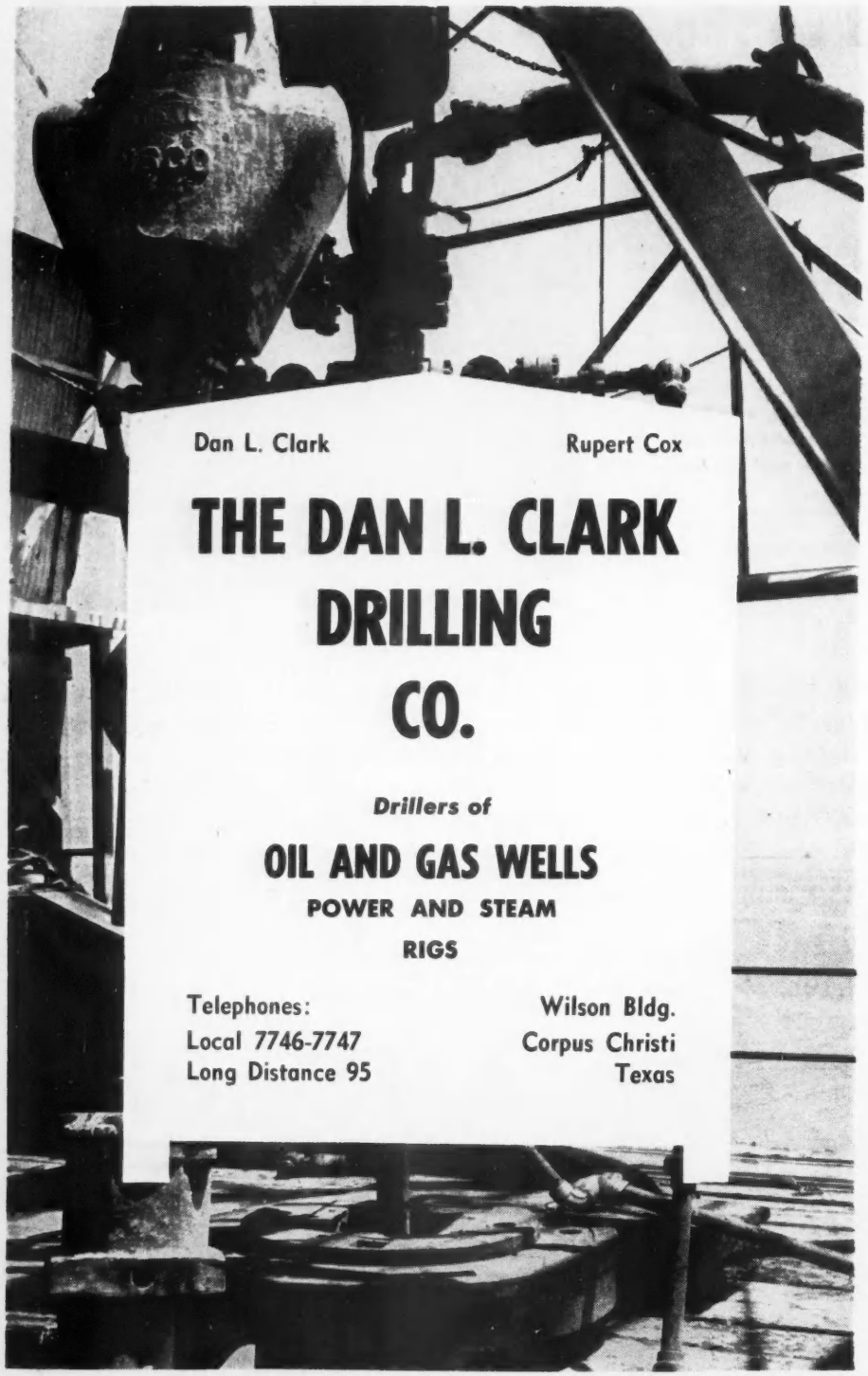
Transfers and Promotions:

B. H. Treybig, Jr., has been promoted to assistant to division manager, Geophysical division, Producing department, The Texas Company. **Tommie Bliss,** production foreman for Texaco, has been transferred from Denver City to Snyder, Texas. **J. V. Rogers** has moved from Ft. Stockton, Texas, to Denver City as production foreman . . . . . **G. Silva,** chief pilot for the Mene Grande Oil Company, C. A., in Venezuela, has been transferred to Gulf Oil Corporation's Tulsa Production division, where he will continue as a pilot. . . . . **E. E. Tucker,** division engineer for Tide Water Associated Oil Company, Midland, Texas, has moved to Snyder, Texas, as district foreman. . . . . **D. E. Luddeke,** district mechanical engineer, West Texas division, Pan American Pipe Line Company, has been promoted to division foreman. **P. E. Hayes** was promoted and transferred from district gauger in the Southern division at Alvin, Texas, to division gauger in the West Texas division, with headquarters at Snyder. **E. W. Kearns** was promoted from mechanical engineer to district mechanical engineer in the Northern division, with headquarters at Longview, Texas. . . . . **Gaylord Campbell,** geologist, British-American Oil Producing Company, has been transferred to Sidney, Neb., to work in the Denver-Julesburg Basin area. . . . . **J. C. Martin, Jr.,** has been transferred from New Orleans, to Calgary, Alberta, Canada, in charge of The Bay Petroleum Corporation's Canadian operations.

O. B. Jordan has been transferred from Magnolia Petroleum Company's Falfurrias Producing district, where he was assistant district superintendent, to assistant superintendent of the Brownfield district, with headquarters at Snyder. **G. L. Nelson,** formerly production superintendent in the Kermit district, has been promoted to district superintendent in the Pampa district. He replaced **J. S. O'Brien,** retired. In the Land department, **W. Brantley Jackson** transferred from the general offices in Dallas to Roswell, N. M., where he will assist **S. P. Hannifin,** district land man. **Marvin S. Jones,** San Antonio Land department, was transferred to the Dallas office.

The following personnel changes in Phillips Petroleum Company's Geological division were announced: **D. C. Hemsell** from superintendent to manager, Land division; **W. B. Weeks** from assistant chief geologist to manager, Geological section; **A. J. Hintze** from chief geophysicist to manager, Exploration section; **W. H. Courtier** from assistant chief geophysicist to chief seismologist. Division assignments—Northwest division: **O. H. Whitcomb,** division landman; **J. H. Turner,** transferred from Denver to Bartlesville, Okla., as division geologist; Southwest division: **H. C. Charles,** division landman; **G. L. Knight** transferred from Amarillo, Texas, to Bartlesville as division geologist; Northeast division: **J. S. Williams,** division landman; **H. H. Charles,** division geologist; Southeast division: **J. E. Kendall,** transferred from Houston to Bartlesville, division landman; **R. E. McPhail,** division geologist; Canadian division: **H. L. Baldwin,** division landman and division geologist. Other personnel changes: **N. H. Newman** transferred from Ardmore, Okla., to Houston as district landman; **H. S. Knight** transferred from Evansville, Ind., to Ardmore as district landman; **C. F. Keller** transferred from Bartlesville to Evansville as district landman; **R. I. Sewell** transferred from Midland, Texas, to Shreveport as district landman, replacing **L. B. Tucker,** resigned; **R. M. Blackmore** transferred from Denver to Salt Lake City as district landman; **A. C. Hornady** transferred from Wichita Falls to Amarillo as district geologist; **Andris Haig,** Denver, appointed district geologist there; **M. H. Steig,** formerly district geologist, Midland, transferred to Bartlesville as special representative to handle problems and assignments.

David Johnston, senior petroleum engineer, Humble Oil & Refining Company, has been transferred from the Southwest Texas division office to the West Texas division office. **W. J. Pung,** district petroleum engineer, was transferred from the Eucutta district, Louisiana division, to the Pampa district, North Texas division . . . **Thomas A. Hendricks,** senior geologist, Stanolind Oil and Gas Company, has been promoted to district exploration superintendent for the Texas-New Mexico district.



Announcing

the new W-K-M BALL VALVE

The W-K-M Venturi-Ball design combines all these advantages in one valve...

smooth throttling—The long life of the new W-K-M Ball Valve in high pressure corrosive and erosive throttling applications has proved its superiority. Smooth flow around ball and its straight line discharge characteristics make it the ideal throttling valve.

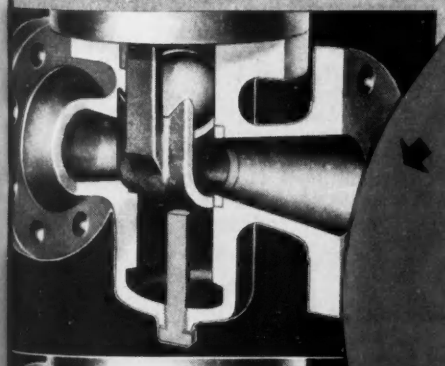
straight-through flow—Wide open flow is unobstructed, non-turbulent with negligible pressure drop. Full flow is approximately double that of a globe valve.

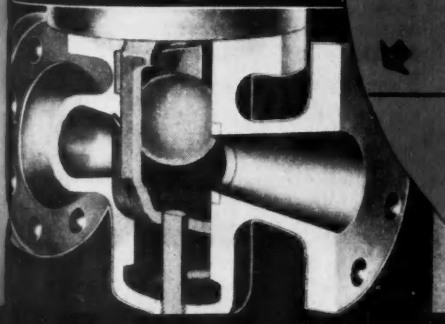
self-cleaning and purging—Due to the venturi design, liquids or gases passing through valve suck out dirt, scale, sediments. There are no corners, passages in which solids or sediments might be trapped.

easy to open and close—
The ball rolls. No appreciable sliding friction. Wedge pads on yoke make valve remarkably easy to open even under adverse conditions.

long life—The ball seats in a different position each time, thus distributing wear over its entire surface, and preventing uneven wear of seat. Valve may be reversed in the line to double its life. Smooth flow minimizes erosion.

Operation of the W-K-M Ball Valve

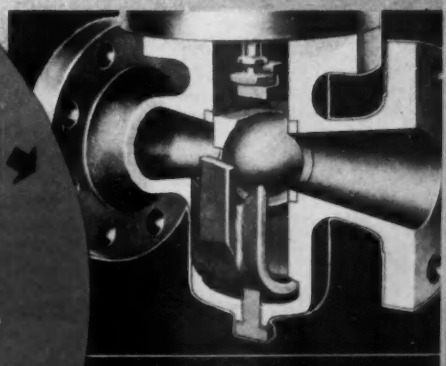




WIDE OPEN
All parts are out of stream—giving straight through unobstructed flow. Yoke member straddles stream and cradles the precision-ground ball.

THROTTLING
In any midposition the ball presents a smooth surface. Non-turbulent flow over a wide range is possible without destructive erosion or wire drawing. Bernoulli effect constantly holds ball firmly against fingers, maintaining throttling position without chatter.

TIGHT CLOSED
Turning hand wheel moves the stem inward, closing the W-K-M Ball Valve. The ball guide, fixed in the valve body, directs the ball into the seat. Locking wedge, moving with the yoke, seats the ball tightly, regardless of pressure and flow conditions. Line contact with high unit pressure between positioned ball and seat assures drop tight, absolute shut-off.



The W-K-M Venturi Ball Valve is the most versatile of general purpose industrial valves and has proved its superiority in hundreds of challenging applications. Write for Bulletin 695 which describes more fully the many engineering advantages of this outstanding new valve.

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MEN IN THE INDUSTRY NEWS

Floyd O. Brett, formerly division production superintendent, Sinclair Oil and Gas Company, Fort Worth, has been promoted to assistant general superintendent with headquarters at Tulsa. **Walter T. Crandall** succeeds Brett.

•

Don W. Conway has been named district engineer for The British-American Oil Producing Company's central district covering Kansas, Oklahoma and Illinois with headquarters at Oklahoma City. **Fred A. Norris,** formerly central district engineer at Oklahoma City, has been transferred to Seymour, Texas, as B-A's southwestern district engineer; **D. W. Holder,** chief accountant, Tulsa office, has been transferred to Calgary.

•

F. S. Wade has resigned as president of Southern California Gas Company, and has been elected chairman of the company's board of directors. **LeRoy M. Edwards** has resigned as vice president and special counsel, but continues as a director. Edwards will engage in private law practice and be retained as special counsel for Southern California.

F. M. Banks was elected president and general manager. He was formerly vice president and general manager.

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It's an important efficiency feature—the free rolling drawworks drum that's standard equipment in Franks Well Servicing Units. And among the components that help to provide this free rolling feature are top quality, custom-engineered bearings, supplied with pride by Aetna.

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J. H. (Jerry) Bartley recent entered geological consulting work specializing on the Permian Basin. Since 1938 he has been senior geologist with University Lands in Midland, interrupted by nearly 4 years service in the U. S. Naval amphibious forces in both the European and Pacific campaigns where he attained the rank of full lieutenant.

J. H. Bartley

A native Texan, he received his B.S. degree in geology from the University of Texas in 1937, minoring in petroleum engineering, and completed 1 year's work toward his master's degree. He is a member of AAPG, and co-authored "Types of Oil and Gas Traps in West Texas and Southwest New Mexico," a paper presented at the 1950 annual meeting of the Association. He is vice chairman of the West Texas Geological Society, and served last year as a member of its Stratigraphic Problems Committee. His new headquarters are at 206 East Wall Street, Midland.

•

L. D. Jurs, vice president of Tide Water Associated Oil Company, has retired after 39 years' service with the company. He remains as a member of the board of directors.

He started with Tide Water Associated in 1911 as a draftsman, and in 1912 was made chief engineer. He was elected a vice president of Associated Oil Company in 1927, and in December was elected a vice president and director of Tide Water Associated.

Since 1940 he has been vice chairman of the Western Division Operating Committee, and a member of the Coordinating Committee.

•

Don M. Rounds, district landman at Wichita, Kans., for The Texas Company, has resigned to become associated with the Fred DeMier, Jr., interests of Miami, Okla., in the purchasing and management of oil properties.

•

H. Ross Bolton, formerly petroleum engineer for The Ohio Oil Company's Terre Haute division, has been appointed chief engineer in Deep Rock Oil Corporation's production division, Tulsa. He succeeds **Kenneth W. Haley** who becomes manager of exploration and production, Creekmore-Rooney, Inc., Tulsa.

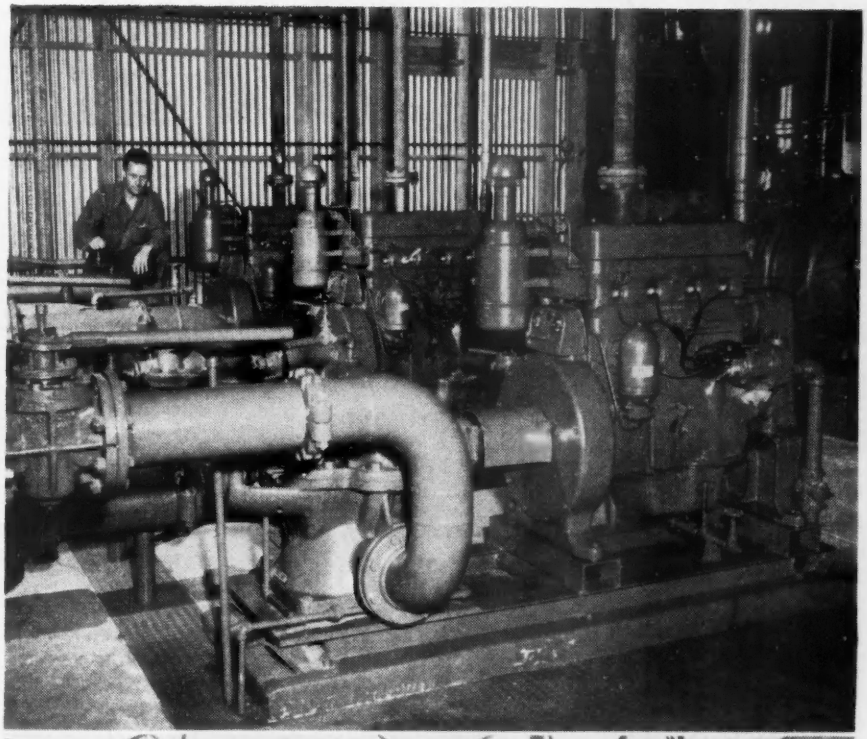
•

A. E. (Sandy) McKay, formerly assistant chief geophysicist, The Atlantic Refining Company, Dallas, Texas has been appointed executive vice president of Southern Geophysical Company, Fort Worth.

•

Jacob E. Lemmons has resigned as geologist, The Texas Company, Wichita, Kans., to enter private consulting work.

ON ANY PUMPING JOB— THE RIGHT POWER IS INTERNATIONAL



The Brea Canyon Oil Company of Brea, Cal., agrees that the right pumping power is International. Three International U-9 engines pump water in their cracking plant vacuum room. One engine pumps cooling water for the vacuum pumps; the second U-9 pumps water for cooling coils and the third is a standby unit to insure against any possible power interruption. The engines drive six-inch turbine pumps and run twenty-four hours a day.

On pump jacks, too, the Brea Canyon Oil Company selects International engines. Twenty International U-6 power units pump wells averaging 4000 feet in depth and producing 300 to 600 barrels a well per day.

Solve your power problems the International way. You can buy dependable International engines from your International Industrial Power Distributor, Power Unit Dealer or oil field supply house.

INTERNATIONAL HARVESTER COMPANY
Chicago

CRAWLER TRACTORS
WHEEL TRACTORS
DIESEL ENGINES
POWER UNITS

INTERNATIONAL HARVESTER

INTERNATIONAL INDUSTRIAL POWER

A. W. Bourne, Jr., a director of Standard-Vacuum Oil Company for the past three years has been elected a vice president of the company. He has a record of nearly 35 years' experience in the international oil business.

Bourne started in the oil business in 1915 shortly after his graduation from Colgate University.

•

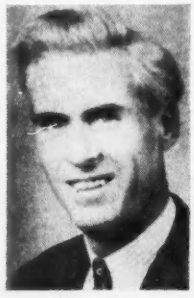
Willis W. Hardy, chief geophysicist since 1939 of Socony-Vacuum Oil Company, Inc., has been appointed assistant chief of the company's Exploration division.

Rear Admiral Thomas J. Kelly, U. S. Navy (Retired), has joined the Socony-Vacuum as an assistant to the chairman of the board. Admiral Kelly retired from the Navy after 33 years' service which included two wars and considerable active combat duty.

Admiral Kelly was raised in the Mid-Continent oil country, where in his early youth he worked as a roustabout in the oil fields. A graduate of the Naval Academy in 1920, he is also a graduate petroleum engineer from the University of Pittsburgh.

•

R. A. Cooper has been named superintendent of field operations for Peak Drilling Company with headquarters at Albion, Ill.



J. B. Buchanan

Bob Franklin

Bob Franklin has joined Al Buchanan Drilling Company, San Antonio, as drilling superintendent for the West Texas district. The company has opened offices in the McClintic Building, Midland, Texas, under the direction of **J. B. Buchanan,** manager of the West Texas district.

Franklin was formerly with J. R. Sharp Drilling Company. He has had wide experience in both cable tool and rotary drilling in West Texas, having spent the past 16 years in West Texas and New Mexico oil fields.

•

Z. C. Ambrose, vice president of Southwest Gas Producing Company, Inc., and Carbons Consolidated, Inc., Monroe, La., was elected president of a subsidiary company, Monla Gas Company, Inc.

•

Dr. John H. Maxson has resigned as division geologist for Anderson-Prichard Oil Corporation in the Rocky Mountains area and is now a consultant at Denver, Colo.

•

E. Clyde McGraw has been elected vice president of Transcontinental Gas Pipe Line Corporation, Houston, and will be in charge of operations for the Texas to New York City natural gas carrier. A graduate of the University of Nebraska, McGraw was formerly vice president of Stone & Webster Service Corporation, vice president of 2 New England gas companies, president of Montaup Electric Company, and vice president of Tampa Electric Company.

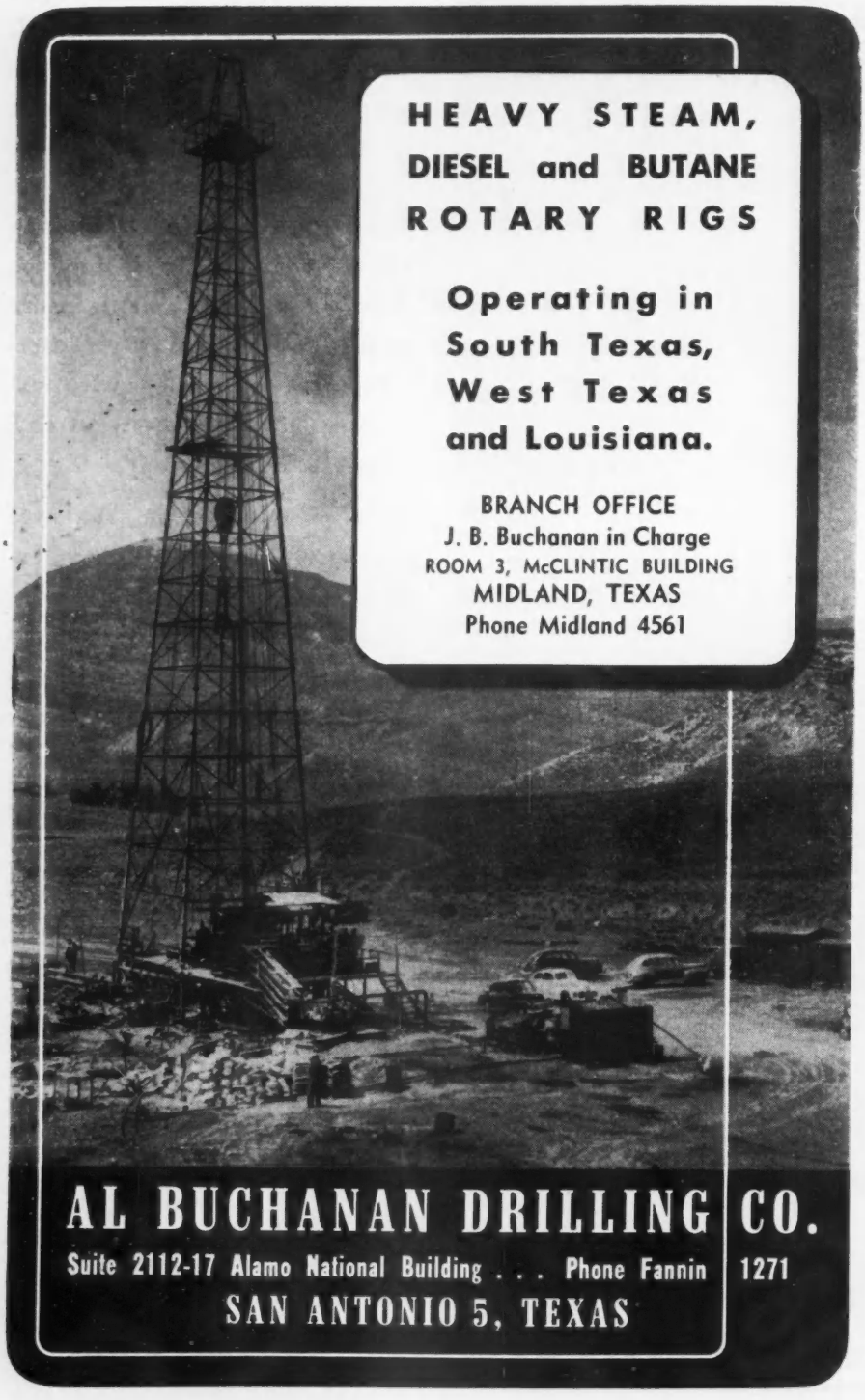
E. Clyde McGraw

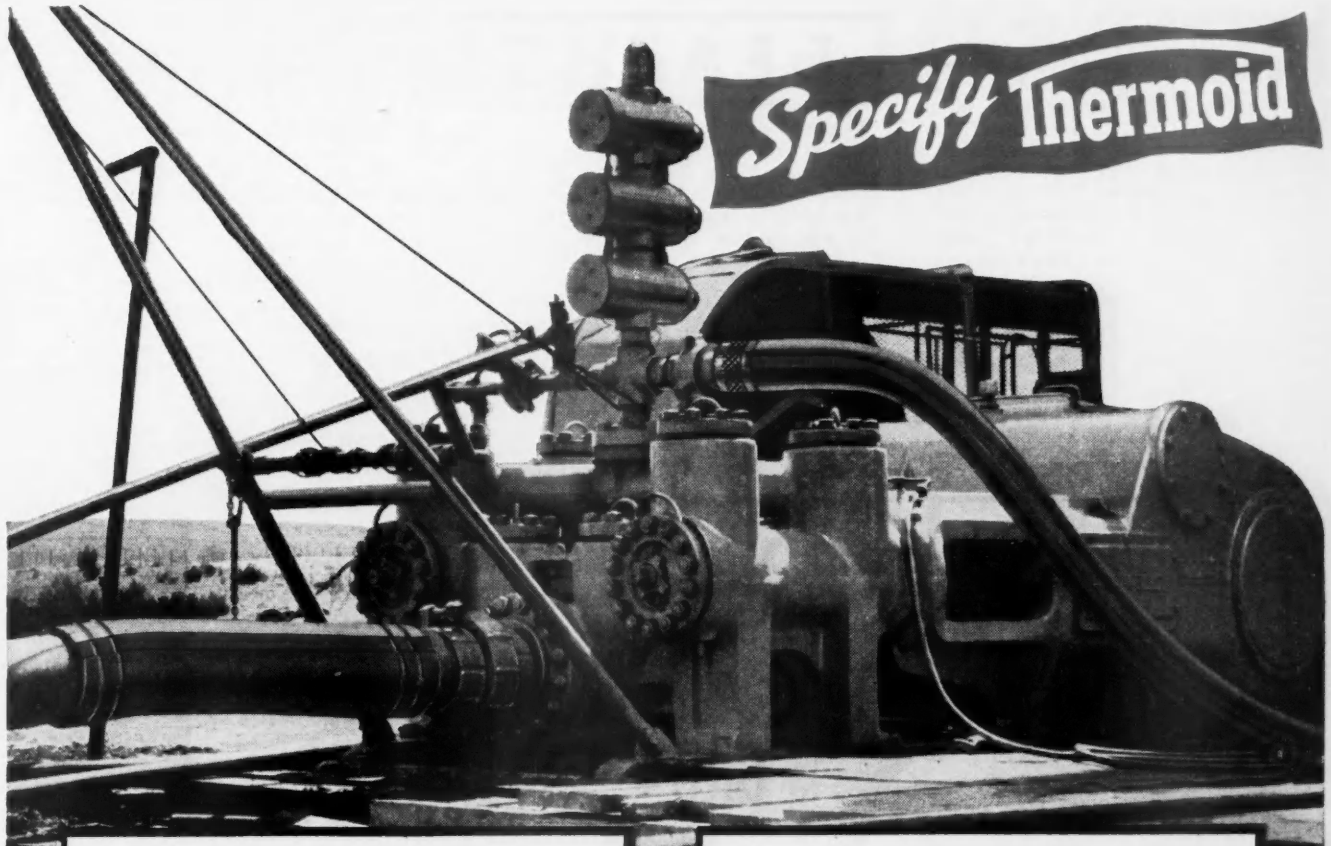
•

R. D. Jackson is in charge of geological work at Signal Oil & Gas Company's newly opened office in the Wimple-Avery Building, Midland, Texas. He was formerly with Cities Service Oil Company, and previously with Magnolia Petroleum Company. Jackson attended both Texas University and Oklahoma University, getting his geological degree from the latter.

•

James C. Condon, formerly with Anderson-Prichard Oil Corporation, has been named geologist and exploration manager of Imperial Petroleum Company.





Specify Thermoid

Mud-Flo Suction Hose

Permits raising and lowering of suction pipe and changing the position of intake without changing connections.

Tube—3/16" thick, oil-resistant, bonded to strong, open-weave breaker fabric.

Reinforcement—heavy galvanized round wire embedded in compound prevents collapse . . . gives maximum flexibility . . . adsorbs vibration and permits unobstructed flow. Strong, heavy, square woven duck plies.

Cover—oil-resistant . . . withstands severe abrasion and weathering.

Furnished with built-in grooved nipples.

Flexible Discharge Hose

Speeds rig-up and tear-down time between mud-pump and standpipe. Eliminates vibration that causes loosened connections and avoids sharp angles that cause pressure loss and turbulence.

Tube—Synthetic rubber . . . abrasion and oil resistant . . . free circulation and long life assured.

Reinforcement—Steel Cables and prestretched fabric for the greatest strength and flexibility.

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Couplings—Streamlined steel . . . full flow built-in and anchored securely for the life of the hose.

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The recognized leader in the field. **Every length pre-tested to 5000 psi before shipment.**

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DEATHS

Howard F. Smith, 80, president of Howard Smith Company, Houston, died July 31. Smith was graduated from Howard College at Marion, Ala., and came to Houston 64 years ago. He was manufacturers' agent for several eastern industrial firms for several years. In 1906 he bought the Stancliff organization and started his own company. Howard Smith Company was founded in 1935.

•

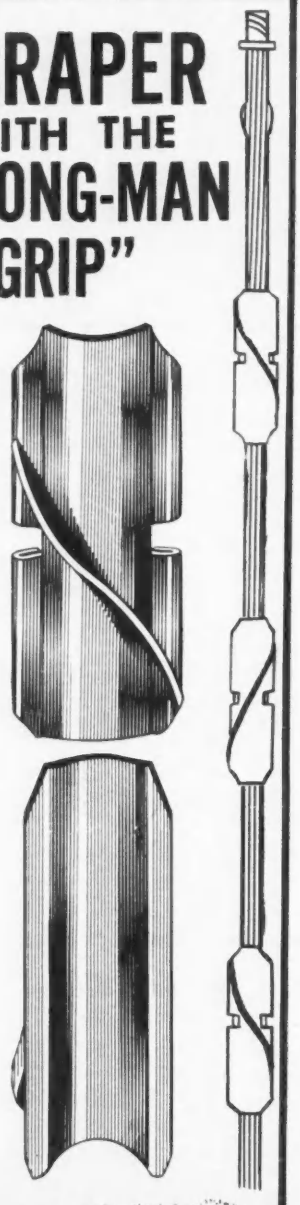
Darrell K. Ford, 43, Williams Brothers Overseas Company, pipe line construction firm, died July 15 in Deraa, Syria. Prior to joining Williams Brothers he was associated with Sinclair Oil and Gas Company and with United Geophysical Company, Inc., in Venezuela.

Lev H. Prichard, Jr., 42, Oklahoma City oil man and member of Anderson-Prichard Oil Corporation, died July 14 in an airplane accident at Hachita, N. M. He was en route from Los Angeles to San Antonio.

•

John M. Cullen, 64, organizer and president of Buda Engine Sales and Service Company, Inc., Tulsa, died July 23 in Jamaica, L. I. Before organizing Buda in 1922 he was service manager for W. C. Norris.

"THE NEW SCRAPER WITH THE STRONG-MAN GRIP"



Sunshine Iron Works has engineered a new advance in strength and wearability through heavier construction of the new M-25 Paraffin Scraper. The two sections of the S-I-W M-25 Scraper can be field installed with simple tools we manufacture for the purpose. The M-25 Scraper gets a snug grip on the rod (up to 5000 lbs., by test), and stays put while it shaves paraffin accumulations from tubing walls. Its two heavy steel blades, spiraled and welded around the shell halves, exert continuous unplugging effect in the hole as they curl off the paraffin with every stroke. Length of pumping stroke determines M-25 scraper spacing. Easy field installation, maximum resistance to wear, and long-operating dependability make the new M-25 S-I-W Paraffin Scraper a profit-saver!

Sunshine Iron Works

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Craig Cullinan, Sr., 55, president of American Republics Corporation, Houston, died August 15 in Houston. The firm he had headed since 1936 was founded by his father, **J. S. Cullinan.** A graduate of Yale University, Craig Cullinan became superintendent of the Galena-Signal Oil Company in 1919. From 1920 to 1926 he was president of the American Petroleum Company. He served as vice president of the American Republics Corporation, then a holding company, for 2 years and then as president for 2 additional years. He again served as president of American Petroleum Company before becoming president of the American Republics producing firm.

•

John McLenahan Crawford, 83, founder of The Parkersburg Rig & Reel Company and chairman of the board of directors, died July 20 in Parkersburg, W. Va. Crawford was reputed to be the oldest active member in point of service in the entire American petroleum industry.

John M. Crawford

A native of Ireland, Crawford came to the U. S. in 1883, settled in Bradford, Penn., and entered the supply industry as a salesman with Bovaird & Seyfang Company. During the next 14 years, he worked throughout the oil fields of Ohio, Pennsylvania and West Virginia. He founded Parkersburg Rig & Reel in 1897.

•

Col. James W. Flanagan, 77, formerly an official in the Standard Oil Company (N.J.) organization, died July 24 in Houston. Flanagan was president of the Andian National Corporation, Ltd., in Colombia until his retirement a few years ago. He was credited with an important role in construction of the 335-mile Demares-Cartegena crude pipe line in Colombia, and had also worked in Mexico for a number of years.

•

W. L. Albert, 72, Oklahoma oilman, died July 25, at Bartlesville, Okla. He was a native of Pennsylvania and went to Oklahoma as a small boy. He was a partner in the Oil Well Supply Company.

•

Harry R. Denton, 80, one of the Mid-Continent's best known landmen, died July 7 at his home near Winslow, Ark. He was with Skelly Oil Company until his retirement in 1940.

•

Henry Murray McDonald, 50, materials superintendent for the Service Pipe Line Company, Tulsa, died July 17. Engaged in the pipe line industry 28 years, he had been with Service since 1922.

•

Burton E. Northrup, 64, owner and operator of Washington Engine & Pump Company, Washington, Penn., died June 26. He had retired in October, 1949.

•

Michael S. (Mike) Karcher, 74, retired drilling contractor, died July 23, in Tulsa. He moved to Tulsa about 1923 and headed the Karcher Drilling Company until retiring about 10 years ago.

Associations

1951 NACE Conference-Exhibit Planned for New York in March

Arrangements have been made for 39 papers to be presented before the 1951 Conference and Exhibition of the National Association of Corrosion Engineers, to be held at Hotel Statler, New York, March 13-16.

L. B. Donovan, Consolidated Edison Company of New York, Inc., is general chairman, and Dr. Norman Hackerman of the University of Texas is chairman of the Technical Program Committee.

T. S. Zajac, Shell Oil Company, Houston, heads the Oil and Gas Industry Symposium, with H. E. Waldrip, Gulf Oil Corporation, Houston, and E. Q. Camp, Humble Oil & Refining Company, Baytown, as co-chairmen.

The Pipe Line Industry Symposium has as chairman S. S. Smith, Shell Oil Company, New York, with W. E. Huddleston, Huddleston Engineering Company, Bartlesville, Okla., and I. B. Tietze, Phillips Pipe Line Company, Bartlesville, co-chairmen.

API Production Division Sets Dates for 4 Spring Meetings

The Division of Production of the API has set the dates for the 1951 spring meetings of 4 of its 5 districts, as follows:

Southwestern district: Hotel Beaumont, Beaumont, Texas, March 7-8-9;

Mid-Continent district: Herring Hotel, Amarillo, Texas, March 21-22-23;

Eastern district: Deshler-Wallick Hotel, Columbus, Ohio, April 3-4-5;

Pacific Coast district: Biltmore Hotel, Los Angeles, May 10-11.

The time and place for the remaining meeting, that of the Rocky Mountain district, will be announced later.

Canadian Geologists Will Hold Regional Meeting September 5-8

A regional meeting of the American Association of Petroleum Geologists and the Society of Exploration Geophysicists will be held at the Banff Springs Hotel, Banff, Alberta, Canada, September 5-8. This meeting is being sponsored by the Alberta Society of Petroleum Geologists and held jointly with the Geological Association of Canada.

Twenty-seven papers will be presented. The program will form a comprehensive coverage of the petroleum geology of Western Canada. It will place particular emphasis on bioherm and biostrome reefs in the Paleozoic and will include several general papers on reef trends and configurations and theory of origin and development. A paper dealing with the newly-prepared Tectonic Map of Canada will also be presented.

The program will include a symposium on geophysical working methods as related to various types of seismic work by foot, horse, and special traction equipment. Papers on helicopter gravity surveys and aerial magnotometer surveys will be presented. One comprehensive paper on Ontario will be included in the program.

Leslie M. Clark, Seaboard Oil Company, Calgary, Alberta, is general chairman for the meeting.

Oil Communications Association Names Officers, Committeemen

H. A. (Dusty) Rhodes, Transcontinental Gas Pipe Line Corporation, Houston, was elected chairman of the National Petroleum Radio Frequency Coordinating Association at its annual meeting in Washington, D. C.

Activities of the association were reviewed at the meeting. From June, 1949 to June, 1950, about 360 users requested frequency recommendations from the 7 regional chairmen. A total of 483 recommendations covering 10,450 transmitters were issued for all phases of petroleum operations. Work on frequency coordination has been done by engineering personnel of many companies. These men are familiar with the field problems involved, types of equipment used by the various companies and the vagaries of propagation peculiar to the region.

Other officers of the association are W. T. Bulla, Natural Gas Pipe Line Company of America, Chicago, vice chairman, and E. H. Wilder, Sun Oil Company, Beaumont, secretary. National committeemen are W. A. Shipman, United Fuel Gas Company, Charleston, W. Va.; J. D. McCullough, Buckeye Pipeline Company, Lima, Ohio; L. C. Bomar, Southern Natural Gas Company, Birmingham, Ala.; G. F. McReynolds, Humble Oil & Refining Company, Houston; W. T. Born, Amerada Petroleum Corporation, Tulsa; L. I. Duthie, El Paso Natural Gas Company, El Paso; B. W. Sorge, United Geophysical Company, Pasadena, Calif.; R. S. Caplan, Gulf Oil Corporation, Houston; and R. D. Wyckoff, Gulf Research & Development Company, Pittsburgh.

California Natural Gasoline Fall Meeting Is Scheduled

Concurrently with his assumption of the duties of president of the California Natural Gasoline Association, R. S. Tulin announced that this year's fall meeting will be a 2-day affair commemorating the Silver Anniversary of the association's founding. The meeting will be held on November 9 and 10, in Los Angeles, immediately preceding the API Annual Meeting November 13-16.

M. L. Arnold, Richfield Oil Corporation, has been appointed fall meeting chairman.

50th Acme Anniversary

Having met a half-century's vicissitudes ... attained and held a position of leadership . . . Acme still perseveres for perfection—as designers and manufacturers of:

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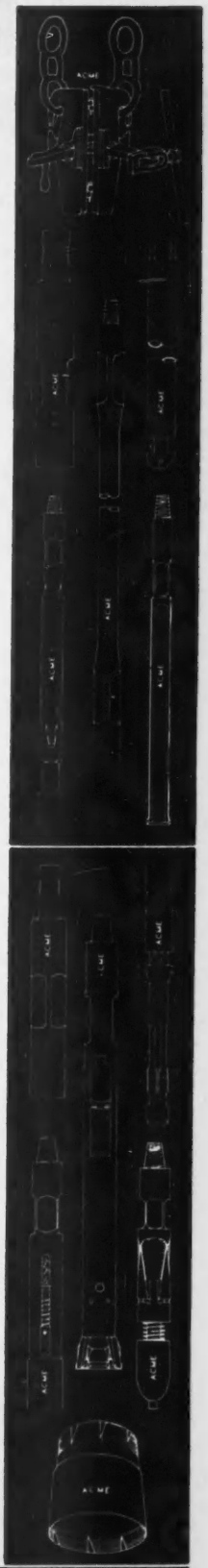

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Magnolia Renews Fellowships At Southern Universities

Magnolia Petroleum Company has announced the renewal of the company's research fellowships at Texas A. & M. College, Louisiana State University, Rice Institute and the Universities of Oklahoma and Texas for the academic year 1950-1951. These fellowships, which carry an annual grant of $2000 each, are in the fields of petroleum engineering, geology, physics, chemical engineering and physical chemistry respectively.

Recipients of these fellowships are selected from university students who have completed at least one year of graduate work. They receive the major portion of the $2000 annual grant and are free to study subjects not connected with the petroleum industry. There are no restrictions placed on the publication of the results of their research and there is no obligation regarding future employment with any of the affiliated organizations.

Sun Man Heads Statisticians

J. Hunter McDowell of Sun Oil Company's statistical research department has been elected secretary-treasurer of the Philadelphia Chapter, American Statistical Association.

Geophysicist Joins Institute's Drilling Research Department

Dr. Peter Dehlinger, geophysicist, has been appointed to the staff of Battelle Institute, Columbus, Ohio, where he will be engaged in research for the oil well drilling industry.

Dr. Dehlinger was formerly with Shell Oil Company at Los Angeles as a seismologist. He is a graduate of the University of Michigan and received his M.S. and Ph.D. degrees in geophysics from the California Institute of Technology.

National C. of C. Resources Committeemen Appointed

Ralph Carr of Denver, former governor of Colorado and an authority in the field of water resource problems of western states, has been named chairman of the National Resources Committee of the U. S. Chamber of Commerce.

Oil and gas committeemen are Merle Becker, executive vice president, W. C. McBride, Inc., St. Louis; B. I. Graves, vice president, Tide Water Associated Oil Company, New York; F. O. Prior, vice president, Standard Oil Company (Indiana), Chicago; John R. Suman, vice president, Standard Oil Company (N. J.), New York; and C. I. Weaver, president, Ohio Fuel Gas Company, Columbus.

Kansas Chapter AAODC Committeemen Are Named

C. H. Todd, R. W. Rine Drilling Company, Wichita, Kansas, chairman of the Kansas Chapter AAODC, has appointed four committees to head up Chapter activities.

Heber Beardmore, Jr., Beardmore Drilling Company, Wichita, Kansas, has been made chairman of the program committee. Publicity for the Chapter will be handled by a committee lead by W. J. Coppinger, Coppinger & Southern, Wichita, chairman.

J. D. Adkins, Adkins Drilling Company, Great Bend, vice chairman of the Kansas Chapter, has been appointed chairman of the membership committee. A committee to study transportation problems of the drilling industry in Kansas is headed by C. L. Roberts, B. & R. Drilling Company, Russell, chairman; A. R. Peters, Powell & Peters Drilling Company, Great Bend; and E. R. Sloyer, R. W. Rine Drilling Company.

Tubular Exchanger Association Chooses Currier as President

C. H. Currier was elected president, and W. C. Beekley, vice president, at the annual meeting of Tubular Exchanger Manufacturers Association, Inc. held at Skytop, Penn. George P. Byrne, Jr., remains secretary-treasurer.

Currier is president of Ross Heater & Manufacturing Company, Inc., Buffalo, N. Y., a division of American Radiator & Standard Sanitary Corporation. Beekley is president of Whitlock Manufacturing Company, Hartford, Conn.

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Like to choose your own job? Your own car? Your own home? Then look around, brother, and act quickly. For we are fast slipping into complete regulation of what we can and cannot do. Legislation already curbs some of our freedom of choice. Other measures before Congress, plus countless laws demanded by "friends" of our economic system, would all but do away with individual freedom.

The situation is dangerous because no *one* of these measures can destroy our way of life. Each is considered harmless. But make no mistake—together they can kill our free, competitive system as effectively as if we voted for outright Socialism.

Let's fight the trend with every possible weapon—the ballot; letters to legislators and other public leaders; discussion groups; lectures; and private conversation. Together, we can maintain the system that raised our living standards to the highest in the world.

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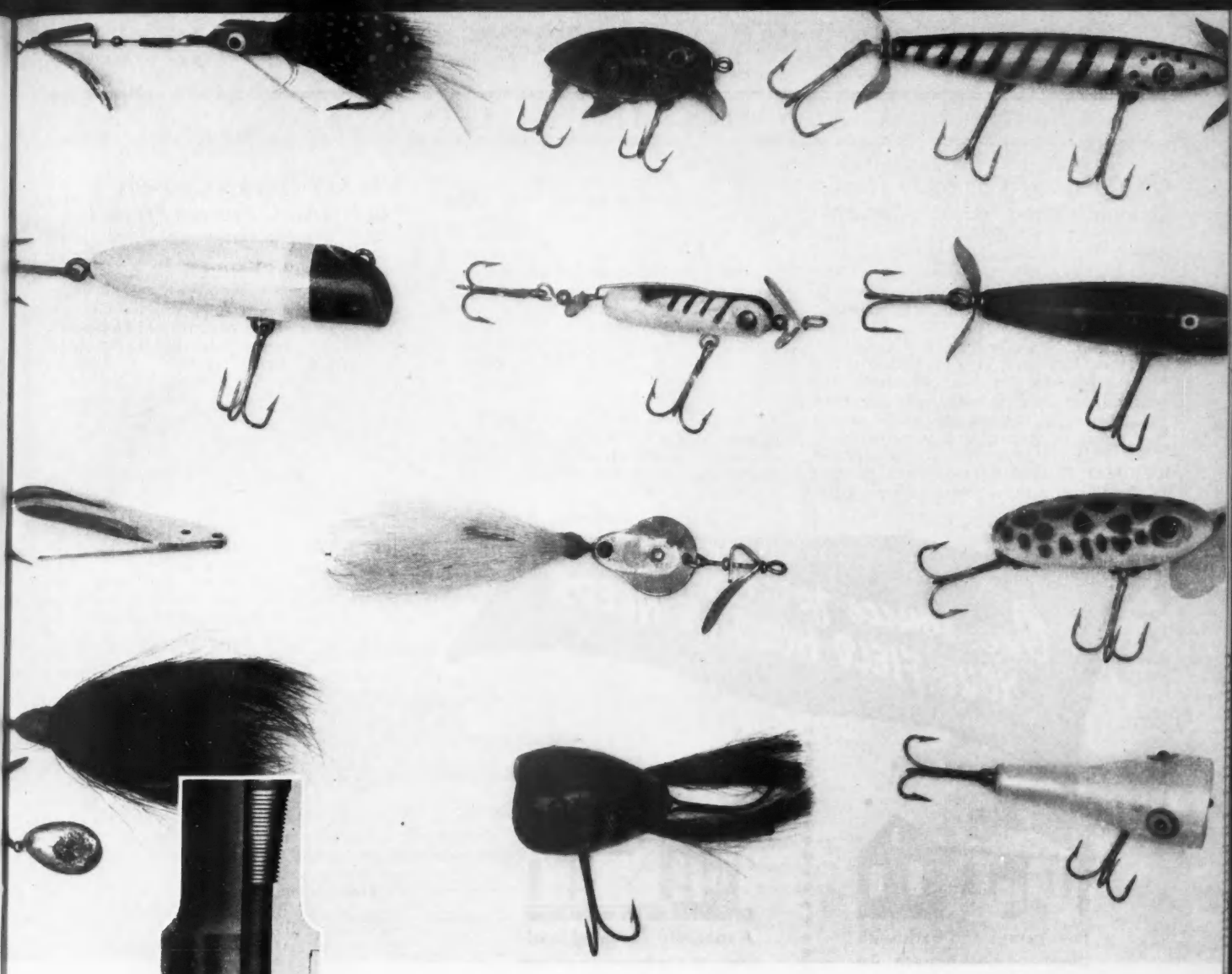

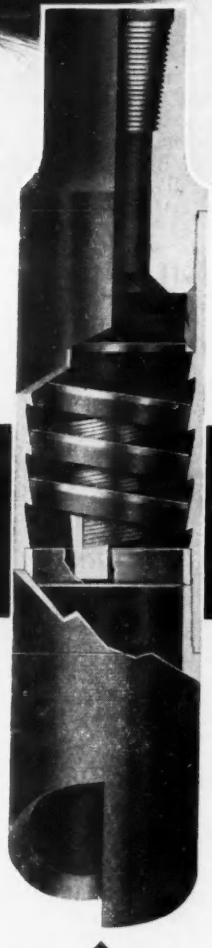

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Oil Company Chairman Heads Commerce and Industry Society

George V. Holton, chairman of the board, Socony-Vacuum Oil Company, Inc., has been elected president of the Commerce and Industry Association of New York, Inc., for the 1949-50 fiscal year.

Holton, a member of the board of directors, had been vice president of the Association since November, 1948. He succeeds Walter Hoving, president of the Hoving Corporation, who served two terms as Association president.

In 1921 Holton became associated with John E. Wellington, general counsel of the Vacuum Oil Company. Two years later, he moved to New York as assistant counsel for the company, was named secretary in 1925, general counsel in 1930 and a director in 1931. When the Vacuum Oil Company merged with the Standard Oil Company of New York in 1931, he became associate general counsel of the Socony-Vacuum Corporation (now Socony-Vacuum Oil Company, Inc.). On the retirement in 1932 of Judge Peter M. Speer, his associate, he became general counsel.

Holton has been a director of the company since 1932, a member of the executive committee since 1933 and was a vice president from 1938 until his election as chairman of the board on March 31, 1948.

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Four rooms and bath with plenty of closet space. An ideal STURDYBILT home for a small family.
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New Officers are Chosen For NGAA Corrosion Project

T. S. Zajac, corrosion engineer, Shell Oil Company, Houston, was elected chairman of the NGAA Corrosion Research Project Committee at the semi-annual meeting in Fort Worth. He succeeds W. H. Stewart, Sun Oil Company, Beaumont, Texas, who has been chairman for the past 2 years. F. A. Prange, chief metallurgist, Phillips Petroleum Company, Bartlesville, Okla., was elected vice chairman of the committee.

These men, together with T. S. Bacon, Lone Star Producing Company, Dallas, H. E. Waldrip, Gulf Oil Corporation, Houston, and P. P. Spafford, Stanolind Oil and Gas Company, comprise the Steering Committee which will direct the activities of the committee in its seventh year of operation.

A cooperative program under the sponsorshop of the Natural Gasoline Association of America, the project has been given the financial support of 29 oil companies and more than $100,000 has been spent in fundamental and practical research.

The Southern Regional Meeting of the NGAA will be held in Tyler, Texas, Friday, October 27. The meeting will be held in cooperation with the East Texas Natural Gasoline Men's Club.

John P. Tucker, president of the ETNGC, Arkansas Fuel Oil Company, Longview, and Chas. A. Schwartz, Caska Corporation, Quitman, are co-chairmen of the program committee.

Headquarters hotel for the meeting will be the Blackstone though technical sessions will be held in the auditorium of the American Legion building.

Shreveport NACE Plans School

Shreveport Section, National Association of Corrosion Engineers, has scheduled a 3-day corrosion school September 13-15 at the Caddo Hotel, Shreveport. Pat Miller, Texas Eastern Transmission Company, is chairman of the program committee. Aim of the school will be to familiarize field men with the nature of and means of controlling corrosion through discussions and demonstrations.

Publications Director Named

LeRoy W. Goodwin is the new director of the publications department, Colorado School of Mines, Golden, Colo., succeeding Harry M. Crain, resigned. He is a University of Colorado graduate and worked for the past 3 years in the newspaper field.

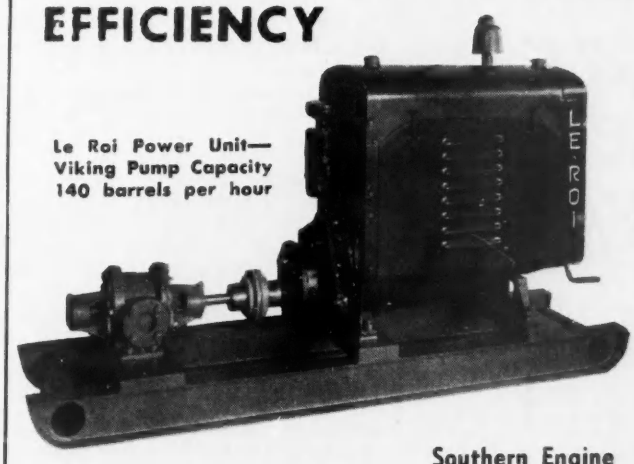
LP-Gas Group Names Secretary

J. C. Crawford, Denver, has been appointed district secretary of the newly organized Mountain States district of the Liquefied Petroleum Gas Association. This is the third district headquarters to be established by LPGA. Others are located in San Francisco, Calif., and Wichita, Kansas.

Anderson Heads LP-Gas Men

Peter A. Anderson, president of Utilities Distributors, Inc., Portland, Maine, was elected president of the Liquefied Petroleum Gas Association.

THE RIGHT TEAM FOR EFFICIENCY



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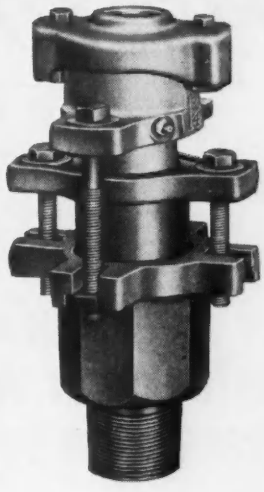

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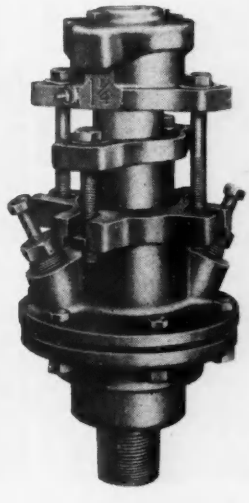

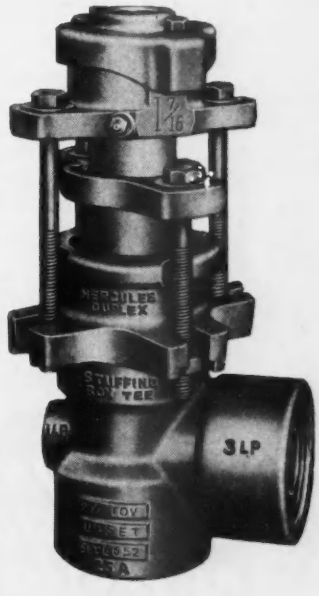

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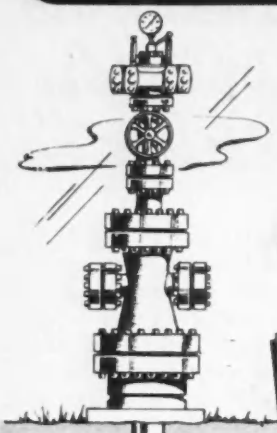

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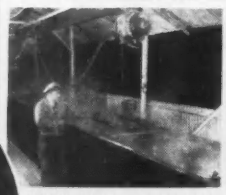

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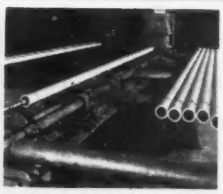
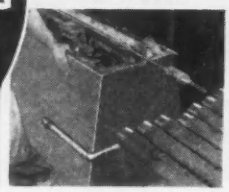
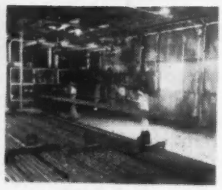


SAND BLASTING TO BASE METAL



AUTOMATIC COATING



CONTROLLED BAKING

All of these steps plus rigid inspection between each operation assures highest quality workmanship.

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First Name In Corrosion Resistance

2520 HOLMES ROAD • P. O. BOX 8123, HOUSTON, TEXAS

WIRE, PHONE OR WRITE FOR TUBE-KOTE TECHNICAL SERVICE BULLETIN

Companies in the News

GENERAL PETROLEUM CORPORATION'S employe benefit program has been improved 11 ways, the company announced. New pension and insurance benefits apply to General Petroleum's 6000 employes in 9 western states. The entire cost of the improvements is to be borne by the company.

Principal changes in the existing plan, which is a fully-funded contributory plan insured with the Metropolitan Life Insurance Company, concern disability benefits, vested rights of employes in company contributions, and early retirement rights.

•

SOUTHERN PRODUCTION COMPANY, Shreveport, has purchased the Danciger family's controlling interest in Danciger Oil & Refining Company, **Dan Danciger,** president of Danciger Company, announced. He stated that two of the terms of the sale were that all employes of the Danciger Company are to be retained by Southern in their present capacities and salaries for at least 1 year, and that Southern will extend to all other stockholders of the Danciger company an offer to purchase their shares at the same price paid to the Danciger family.

•

PHILLIPS PETROLEUM COMPANY directors have named the company's old office building at Bartlesville, Okla., the "Phillips Building," and the new building there the "Adams Building," in honor of **Frank Phillips,** chairman of the board, and **K. S. Adams,** president.

•

THOMAS P. PIKE DRILLING COMPANY has moved to its new and enlarged Long Beach, Calif., offices and yard, according to **H. G. Haney,** vice president and general superintendent. The new quarters at 3460 Cherry Avenue cover approximately 5 acres. The administration area provides offices for Haney, **John Fowler,** assistant superintendent, **Harold Jordan,** assistant and **Perry Isham,** head mechanic, as well as shower facilities and dressing rooms for workers and garage space.

•

NORTHERN NATURAL GAS COMPANY plans to construct a new main office building near 24th and Dodge streets in Omaha, Neb. Expansion of the company's pipe line system since the end of World War II has resulted in increasing the capacity from 242 million cubic feet to 600 million cubic feet. This has necessitated large increases in personnel, to the extent that the company has outgrown its present space and will require further office space.

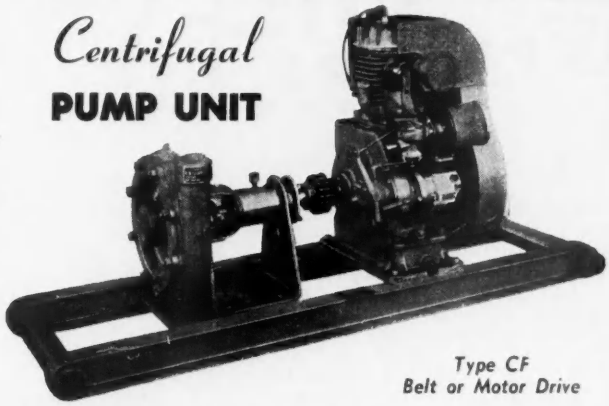
Construction of the new 6-story building is part of the company's $50 million 1950 expansion program.

•

STANDARD OIL COMPANY OF CALIFORNIA won a certificate of award from the Advertising Association of the West at Los Angeles, for its series of institutional advertisements appearing in 536 western newspapers. **M. A. Mattes,** manager, Advertising department, and **G. Stewart Brown,** manager, Public Relations department, accepted the award for the company.

LOCKETT-WORTHINGTON

Centrifugal
PUMP UNIT



Type CF
Belt or Motor Drive

NO MATTER what your pumping problem may be, Lockett Dealers—from warehouses located at, or near, the principal oil fields of Texas and Louisiana, and backed by a large replenishing stock at our Houston and New Orleans Warehouses — can supply complete pumping units for every pumping need.

Lockett Dealers can promptly furnish dependable Worthington Pumps, adapted for use with any type or make of power unit — gas, gasoline, Diesel, or electric motor; and, also *genuine* Worthington Repair Parts from near-by warehouse stock.

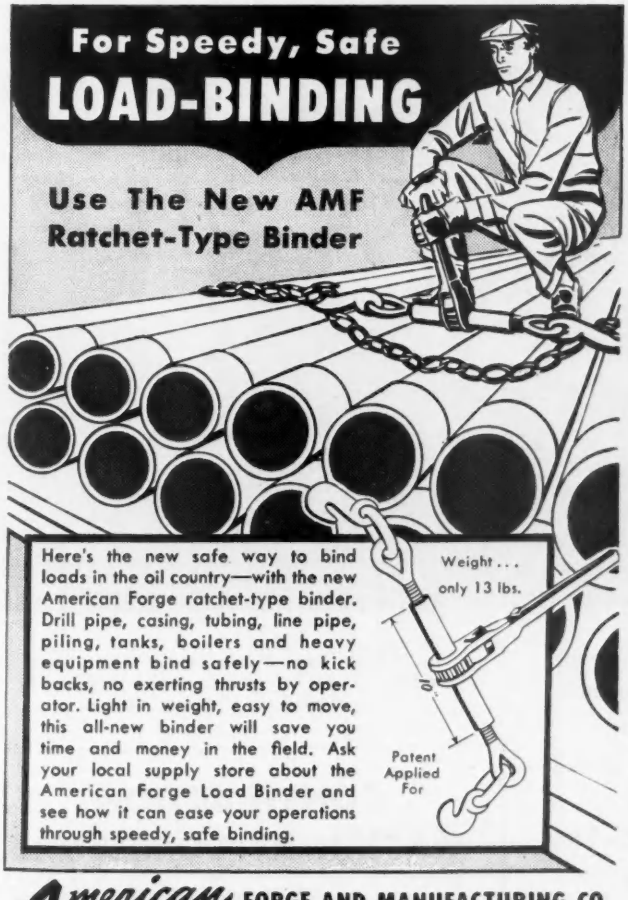
Today, as heretofore, your best assurance of getting years of efficient, uninterrupted pumping service is to buy your pump needs from a Lockett Dealer.

A. M. LOCKETT & COMPANY, LTD.

NEW ORLEANS HOUSTON DALLAS

For Speedy, Safe
LOAD-BINDING

Use The New AMF Ratchet-Type Binder



Here's the new safe way to bind loads in the oil country—with the new American Forge ratchet-type binder. Drill pipe, casing, tubing, line pipe, piling, tanks, boilers and heavy equipment bind safely—no kick backs, no exerting thrusts by operator. Light in weight, easy to move, this all-new binder will save you time and money in the field. Ask your local supply store about the American Forge Load Binder and see how it can ease your operations through speedy, safe binding.

American FORGE AND MANUFACTURING CO.
812L Shore Avenue • Pittsburgh 12, Pa.

Now! . . . unrivaled results treating water the TRICO way

Water Conditioning by the Ion Exchange Method

TRICO—A WEST TEXAS INDUSTRY OFFERS INDUSTRY-WIDE SERVICE

Twenty years experience treating water with several years of experimentation in ion exchange have helped build a degree of perfection into Trico equipment that surpasses other known methods. Yes, here in West Texas we have developed a better way for conditioning water and it's applicable wherever the quality of water supply presents you with a problem. Write for complete information, including performance data.

OUR COMPLETE LINE OF EQUIPMENT AND SERVICES INCLUDES:

- Demineralizers
- Filters
- Vacuum Degasifiers
- Water Analysis
- Zeolite Softeners
- Alkalinity Removal
- Mineral Exchangers
- Reconditioning old plants
- Lime and soda plants
- Zeolites and Filter Media
- Bacteria and corrosion control on water flood projects
- Corrosion inhibitors for secondary recovery
- —All-Steel WELDED TANKS, all sizes
- —Plastic-Lined and Rubber-Lined TANKS

TRICO MFG. CO.

MAIN OFFICE—ODESSA, TEXAS
P. O. Box 1768 – Phone 3422
PLANT: 2512 West 2nd Street, ODESSA, TEXAS
DALLAS OFFICE—500 Santa Fe Bldg., Phone: Riverside 6051

EQUIPMENT AND SERVICE SUPPLIERS' NOTES

Hansen Is Assigned as Coordinator Of Halliburton Company Departments

R. M. (Dick) Hansen, who has been works manager of Halliburton Oil Well Cementing Company's home office plants and shops at Duncan, has been promoted to the new position of co-ordinator for Halliburton's Engineering Materials, Manufacturing and Transportation departments.

R. M. Hansen

Succeeding Hansen as works manager is Paul Scheefers, who had been Hansen's assistant.

The promotions followed W. D. Owsley's elevation to technical vice-president, with Hansen assuming many of Owsley's responsibilities.

Hansen was graduated from Rensselaer Polytechnic Institute, Troy, N. Y., in 1934 with a M. E. degree. He joined Howco in May, 1936, as a truck driver at Wichita, Kansas, became a cementer the following year and was promoted to field engineer in 1938. Subsequent transfers took Hansen to Illinois, Texas, Louisiana and the Rocky Mountain area. He came to Duncan in 1942 as a War Products department testing engineer, later becoming War Products chief engineer and Halliburton's assistant chief engineer. He was named Works Manager in June, 1945.

Bovaird and Mud Products Create Mid-Continent Drilling Mud Service

Bovaird Supply Company and Mud Products, Inc., have launched a joint venture for the sale and distribution of Baroid products, drilling mud additives and chemicals. The new Bomud Company, with offices in the Philtower Building, Tulsa, is under the active management of E. R. Albert of Mud Products, Inc., in cooperation with R. E. Batchelor of Bovaird Supply Company. Orders placed with either associate firm will be handled by the Bomud organization which will maintain its own trucking facilities.

The territory covered includes Kansas, Nebraska, Colorado; Cimarron, Texas, and Beaver counties of Oklahoma, and all counties in the Panhandle of Texas north of and including Deaf Smith, Randall, Armstrong, Donley and Collingsworth counties.

Hughes Tool Moves Siems to Houston As Assistant General Sales Manager

Hughes Tool Company has appointed W. H. Siems, former export manager of the New York office, as assistant general sales manager with headquarters in Houston. He will assist in the general supervision and coordination of the company's field sales and service activities, both domestic and foreign.

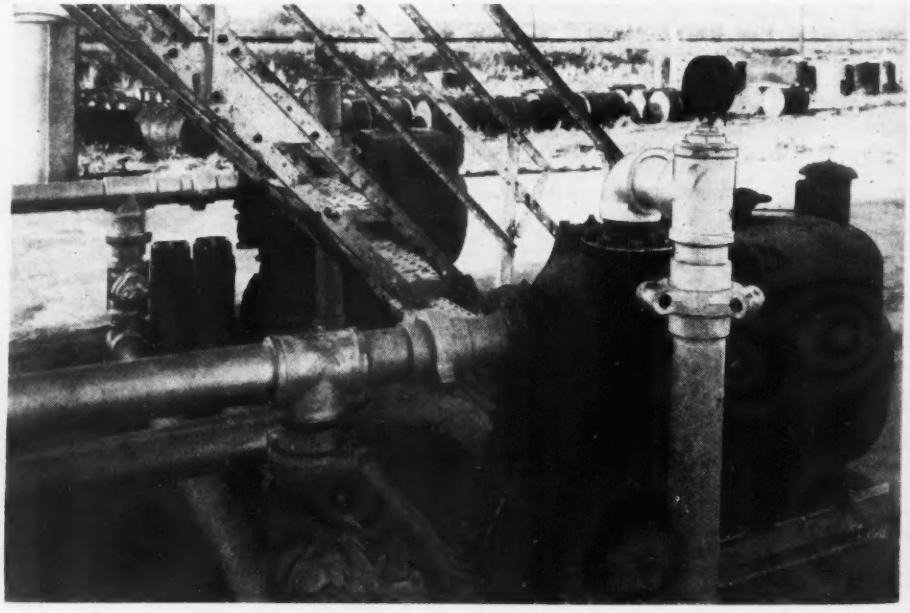
W. H. Siems

Siems joined the company in 1920. While serving as export manager he traveled in more than 30 foreign countries. He will retain major responsibilities in the foreign sales organization, with O. B. Latrobe taking on added duties as foreign sales manager in New York.

CMC

Pumps

. . . FOR THE OIL INDUSTRY



Two C.M.C. Dual Prime Model 420 Pumps loading lub-oil for Mid-Continent Petroleum Corporation at Odessa, Texas.

Exclusive twin jet design advantages give C.M.C. Dual Prime Pumps longer life, minimum maintenance and outstanding operating performance.

They are simple, rugged, fool-proof—and every pump is tested under most severe conditions.

Automatic priming speed on lifts up to 25' is unattached. Sizes 1½" to 10"—3,000 to 240,000 G.P.H.

Write today for full details—our qualified engineers will gladly help solve your pump problems.

CONSTRUCTION MACHINERY COMPANIES

WATERLOO, IOWA

I like to fish but not in oil wells!

use NATIONAL SEAMLESS for less down-the-hole trouble

THE consistently fine records achieved with NATIONAL Seamless Oil Country Goods on successful deep producers indicate almost complete freedom from fishing jobs due to pipe failure! Fewer fishing jobs mean more economical operation and smoother going all the way.

The uniform strength and toughness of every part of every section is mainly responsible for the long and dependable service you get from NATIONAL Seamless Drill Pipe, Casing, and Tubing. For in our method of manufacture, each length of NATIONAL Seamless is pierced from a billet of high quality steel. This piercing operation—one of the most drastic operations in the forging industry—demands the very best steel. The finished product is absolutely free from any longitudinal weld which means uniform wall strength throughout.

For more information on NATIONAL Seamless Drill Pipe, Casing, and Tubing, write National Tube Company, Frick Building, Pittsburgh, Pennsylvania. Ask for Bulletin No. 15.

• • •

NATIONAL TUBE COMPANY, PITTSBURGH, PA.
UNITED STATES STEEL EXPORT COMPANY NEW YORK

USS

NATIONAL SEAMLESS
drill pipe...casing...tubing

UNITED STATES STEEL

The Annual Sales Conference recently held by Hughes Tool Company at its Houston general offices was attended by more than 100 sales and field operating supervisors and representatives. Following the general meeting, a special meeting was held with company officials and export sales representatives from England, Europe, South America, and Mexico for a discussion of international sales problems.

Lane-Wells Company Field Manager Is Elected to Board of Directors

Morton T. Higgs, manager of field operations of Lane-Wells Company, has been elected a member of the board of directors.

He has been connected with the petroleum industry for 30 years, serving as a geologist for Interocean Oil Company, The Atlantic Refining Company, Gulf Oil Company of South America, and Sun Oil Company, and as Gulf Coast regional manager for Sperry-Sun Well Surveying Company before joining Lane Wells as Gulf Coast manager in 1938. Higgs is also vice president and a member of the board of directors of the Lane-Wells Canadian Company.

The Lane-Wells Canadian Company has hired David W. Barnett as a sales geologist at Calgary. Barnett, a graduate of the University of Alberta, was a geologist for Kennco Explorations of Canada in northern British Columbia and did exploration work in the Lake Athabaska region with Eldorado Mining and Refining Company.

Cameron Appoints New Officers

J. S. Abercrombie, president, announced that the board of directors of Cameron Iron Works, Inc., has made the following appointments: Ralph H. McCullough, secretary-treasurer; Edmond L. Lorehn, executive vice president; Herbert Allen, vice president and general manager; and Olle L. Lorehn, vice president and assistant to the general manager.

United Centrifugal Pumps Appoints V. Lobanoff as Chief Engineer

United Centrifugal Pumps, division of United Iron Works, Oakland, Calif., has appointed V. Lobanoff chief engineer.

V. Lobanoff

Lobanoff has been credited with major responsibility for development of a number of new United Centrifugal Pump designs, and a program to affect interchangeability of parts in each line. In his new post, he will continue to direct new design development.

To The Top of The Reef
Or
Down
To the
Ordovician

Guy Mabee Drilling Company

has the light, medium or heavy duty Rotary Rig to push your hole down faster, at lower cost, throughout the Permian Basin of West Texas and New Mexico.

If you would like to establish connections with a dependable driller in the Permian Basin address your inquiry to:

GUY MABEE, *President*

McClintic Building
Midland, Texas

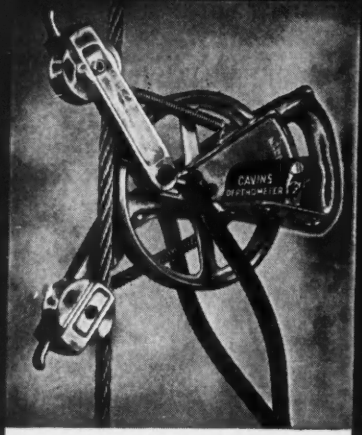
GUY MABEE DRILLING COMPANY

Here's the Accurate Way to take Wire Line Measurements

Easy to use

Light and handy to carry

No more "Stringing-in" Guess Work



Gives you accurate depth

Direct reading

Pays for itself in a short time

Hundreds of Cavins Depthometers are in successful service giving their owners direct-reading, accurate well measurements. This strong, simple device comes in a handy carrying case (weighs only 17 pounds)—is put on the line in a few seconds, and tells you where bottom is quickly and dependably. —Write for folder to The Cavins Co., 2853 Cherry Ave., Long Beach 6, California.

THE CAVINS DEPTHOMETER

OIL CENTER TOOL COMPANY

HOUSTON, TEXAS

JOHN MAHER
PRESIDENT

"WE SEEK YOUR COOPERATION TO HEAD OFF GROWING INFLATION..."

AN IMPORTANT STATEMENT OF POLICY BY O-C-T

International developments of the past several weeks have brought up the subject of shortages and undoubtedly, the oil industry will feel the effects immediately.

The OIL CENTER TOOL COMPANY wishes to advise its customers that it feels that it will be able to take care of their orders as our inventory levels and firm commitments indicate that we will be able to supply the normal demand for O-C-T equipment.

We have always made it a company policy to deal with legitimate houses whom, we know, will honor any contract they made, barring, of course, government intervention, but barring government intervention, WE WILL TAKE CARE OF OUR CUSTOMERS.

This situation could be unbalanced, however, by unnecessary purchasing and scare buying and we therefore, urge all of our customers to place their orders with us for equipment when and as needed, rather than placing orders on a "future needs" basis.

We believe it is a direct and absolute responsibility of management to do everything in its power to head off the growing inflation and to this end, we seek your cooperation.

We wish to assure you that we very much appreciate your business and we will continue to produce the finest equipment in the field.

Sincerely,

John Maher

More Than Eighty Lane-Wells Company executives and sales engineers are pictured at the company's general sales conference in Houston. Technical discussions of Lane-Wells services and products were made by division engineers and geologists at the conference, which was under the direction of James D. Hughes, general sales manager.

Operating in

West Texas

and

New Mexico

Carl B. King Drilling Company

305 McClintic Building

Midland, Texas

P. O. Box 270 Telephone 2164

Well Instrument Developing Company Appoints California Distributor

Well Instrument Developing Company, Houston, has appointed Dale Company, 6412 McKinley Avenue, Los Angeles, as its western states representative, Hubert Guyod, president of the Houston firm, announced.

Dale Company will handle sale, rental and repair of Widco Electric Loggers and accessory equipment, and will render an electric logging service with Widco equipment in wells up to 4000 feet deep.

Schriber Apointed Vice President And Director of Earle M. Jorgensen

Charles Schriber, manager of sales of the Earle M. Jorgensen Company's Los Angeles office, has been appointed a vice president and director.

Charles Schriber

Prior to becoming associated with Jorgensen in January of this year, Schriber was a vice president of Republic Supply Company of California, where he started his business career in 1940 upon graduating from Williams College with a BA degree. He served as a pilot in the AAF from 1942 to 1945.

Tube Turns of Canada Appoints District Manager in Ontario

Arthur H. Brodie has been appointed district manager, with headquarters at the company plant in Chatham, Ontario, for Tube Turns of Canada, Ltd. He will also spend considerable time in Toronto.

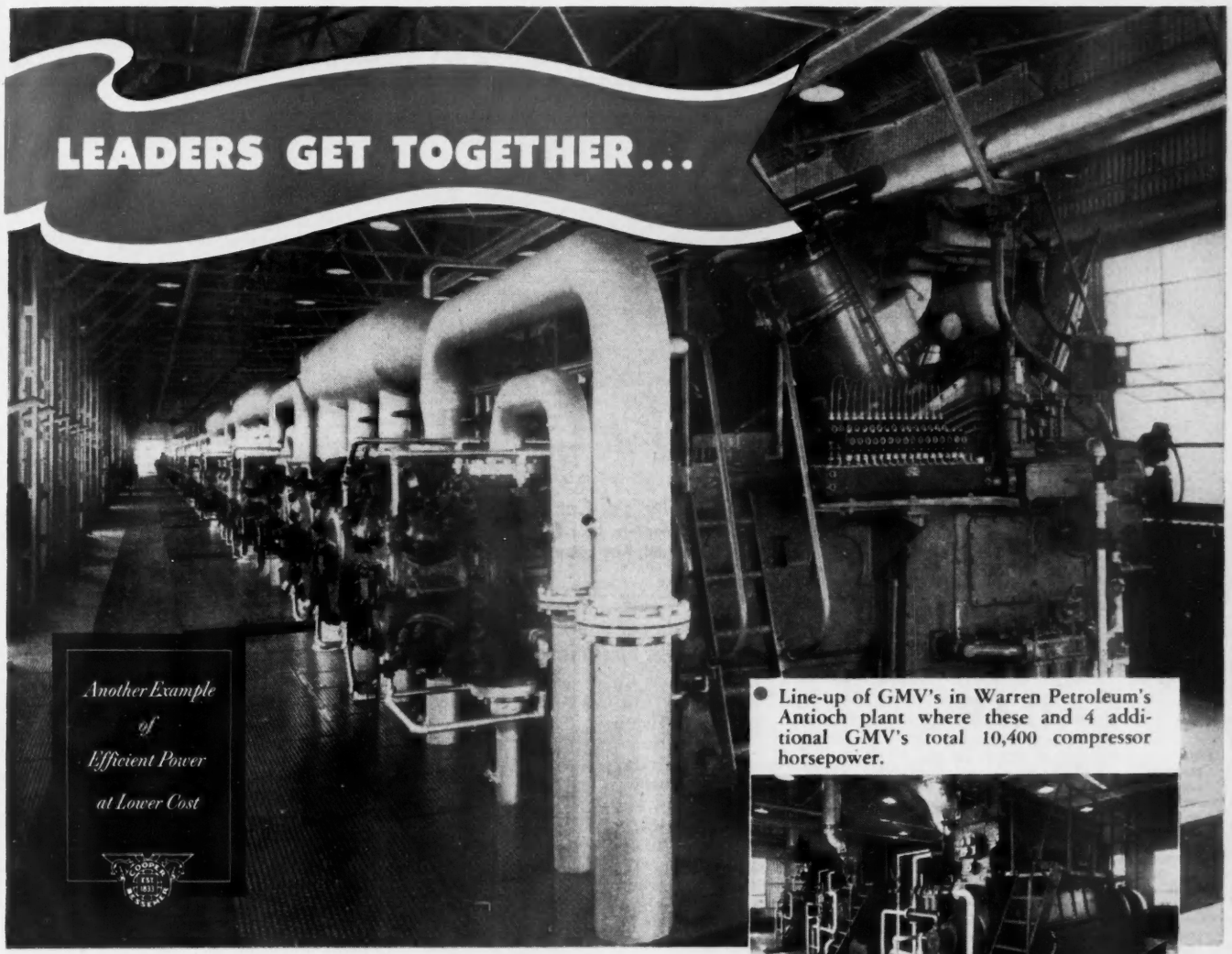
Arthur H. Brodie

Brodie attended the Montreal Technical School. He served in the Canadian Army during World War II and was with International Equipment Company before he joined Tube Turns in March.

Schlumberger Promotes Decker

G. J. Decker, who has been on a temporary assignment in Edmonton, Alberta, Canada, for Schlumberger Well Surveying Corporation, has returned to the U. S. and promoted to Kansas division manager, with headquarters in Wichita. Louis C. Chombert, former Kansas division manager, has been transferred to Houston.

LEADERS GET TOGETHER...



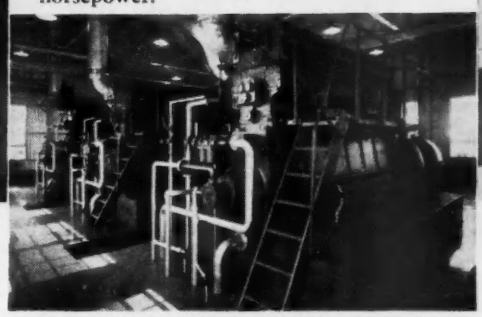
for modern, highly efficient operation

Warren Petroleum Corporation, pioneer in gasoline extraction, has been long recognized as a leader in the natural gasoline industry. Recent plant expansions and processing advancements, aimed at greater propane recovery, contribute to the company's truly enormous field processing operation and help assure continued leadership.

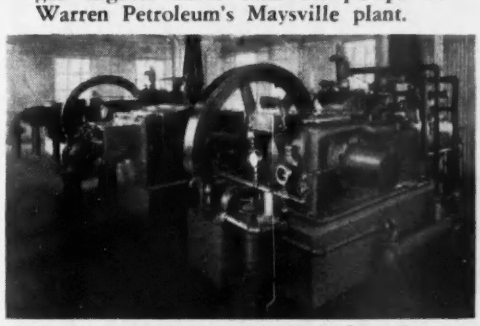
The modern compressors, engines and pumps shown here are part of Warren Petroleum's most recently added facilities. They are now serving in various phases of the Company's gasoline work and pressure maintenance. All are Cooper-Bessemer units, built by a company likewise recognized as a leader in its field . . . *for over a century!*

When planning your power, compressing and pumping needs, be sure to check with Cooper-Bessemer on the new features, new developments that continue to uphold this kind of leadership.

● Line-up of GMV's in Warren Petroleum's Antioch plant where these and 4 additional GMV's total 10,400 compressor horsepower.



● These three 505 hp Cooper-Bessemer JS-6 gas engines drive lean oil pumps in Warren Petroleum's Maysville plant.



● At Warren Petroleum's Holliday plant, Cooper-Bessemer 4 cylinder twin-line pumps, driven by Cooper-Bessemer 150 hp GAW gas engines, are in gasoline work, each handling up to 14,500 bbl of lean oil a day at 800 psi.

The
Cooper-Bessemer
Corporation

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

New York City Washington, D. C. Bradford, Pa. Parkersburg, W. Va. San Francisco, Calif. Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle, Wash. Tulsa, Okla. Shreveport, La. St. Louis, Mo. Los Angeles, Calif. Caracas, Venezuela Gloucester, Mass. Calmes Engineering Co., New Orleans, La.

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GIDDENS-LANE BUILDING
SHREVEPORT, LOUISIANA

Red Top (Hydrostatic)
BAILER

A QUICK, POSITIVE LOAD REGARDLESS OF FLUID LEVEL.
Ideal also for fishing small objects—widely used for drilling in (completing) wells, and for drilling cement or plastic plug overages.

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SHREVEPORT, LOUISIANA, U. S. A.
Office: 804 Erie St., Phone 7-7511
If no answer call 2-2023, 7-2149, or 2-5842
Factory: 2134 Greenwood Rd., Phone 2-2023
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JENA, Germany Machine Co.
RODESSA, Republic Supply Co.
SERVICE, phone Jack Willhoit, 4662 Lafayette, 7-7511 Shreveport.
Arkansas:
EL DORADO, Cox Supply Co.
Oklahoma
OKLAHOMA CITY, Dawson Service Co., Phone 54-7577
SERVICE, phone 54-7577, Oklahoma City.
Texas:
CORPUS CHRISTI, A. S. Baylor, Phone 2-2461.
WICHITA FALLS, Hudson-Eads, Inc., phone 2-8584.
BORGER, Nichols Tool Company, phone 350.
KILGORE, Spain Brothers, phone 2981.
SERVICE, phone 3, Turnertown; 2981, Kilgore; 2-8584, Wichita Falls; 350, Borger.
Mississippi:
NATCHEZ, Cox Supply Co.

Standco
NO-SMOKE

STANDCO BRAKE LINING
Stands the gaff and gets the job done without scoring brake rims. See pages 3973-3978, Composite Catalog.

Standco Brake Lining Co.
HOUSTON

HOUSTON LABORATORIES
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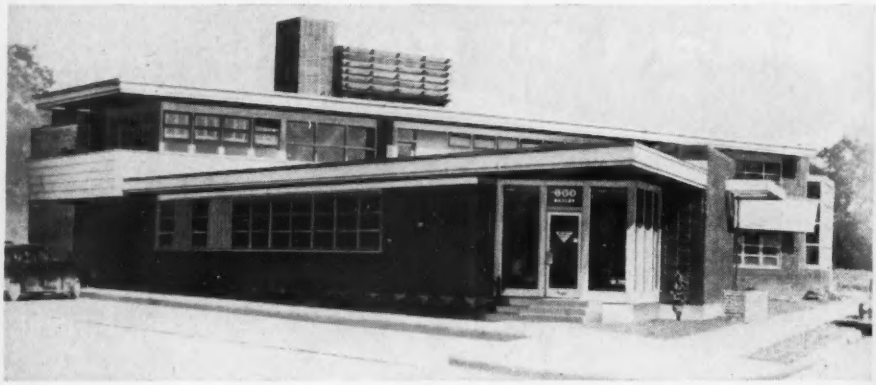
Hydrocarbon Gas Analyses, Reservoir Equilibria Studies for Crude and Condensate well, Waters, Brines, Corrosion and Industrial Analyses.
Phone CApitol 1319, Box 132, Houston, Texas

EQUIPMENT and SERVICE SUPPLIERS' NOTES



Southern Geophysical Company has moved into its new office building at 600 Bailey Avenue in Fort Worth. Completely air-conditioned, the 16-room suite of offices accommodates executives, supervisory personnel, has computing and drafting departments and a map reproducing laboratory.

Petroleum Engineer Joins Oil Loan Division of Tulsa First National

R. H. Gwinner, for 6 years chief engineer for Sunray Oil Corporation, joined the Oil Loan division of the First National Bank and Trust Company of Tulsa.

R. H. Gwinner

Gwinner spent the 11 years following his graduation in petroleum engineering from the University of Pittsburgh School of Mines in covering various phases of the oil industry throughout the Mid-Continent and Appalachian areas. In 1934 he joined the Shell Oil Company as appraisal engineer, working in North Texas, Kansas, Oklahoma, and Illinois. He was senior exploitation engineer with Shell when he resigned in 1944 to go to Sunray.

Oil Well Supply Company Announces Several Changes in Its Personnel

Paul H. Shepherd, a veteran of 34 years' service with Oil Well Supply Company, has been named assistant manager of the Tubular department. He will coordinate tubular activities in the Gulf Coast, Central Midwest, Mid-Continent and Rocky Mountain divisions.

Don H. Schoonover has been appointed manager of Oil Well's Big Spring, Texas, store, succeeding Jack Smith, who becomes district representative in West Texas with headquarters at Big Spring.

R. F. Cann has been transferred from Los Angeles to Houston as manager of tubular sales for the Gulf Coast division. He held sales positions in Fort Worth, Dallas, and Houston before going to Los Angeles in 1944.

J. W. Mays, formerly manager of Oil Well's Beaumont, Texas, store, has been assigned to Gulf Coast division field sales with headquarters in Houston. He is replaced by J. T. Love, district representative of refinery and pipe line equipment sales at Beaumont.

Oil Well has announced that its London office, under C. T. Longcroft, is now located at 5 Queen Street, London E. C. 4.

Joy Manufacturing Company Elects Platts Executive Vice President

E. M. Platts, former sales vice president of Joy Manufacturing Company, has been elected executive vice president succeeding the late Arthur S. Knoisen.

E. M. Platts

Platts began his business career with Jones & Laughlin Steel Corporation in 1913. He worked for Benedum Trees Company and was general manager of Pittsburgh and Wheeling Coal Company before establishing his own manufacturer's agency for mining machinery in 1929. In 1932 he was one of the founders of the La-Del Conveyor & Manufacturing Company which was taken over by Joy in 1945.

Clifford Wood Joins Catawissa

Clifford Wood, formerly sales manager of Jefferson Union Company, has joined Catawissa Valve & Fittings Company as Eastern division manager, with headquarters in New York City.

Gardner Brothers Drilling Co.
Dallas, Texas
ALL TYPE RIGS
West Texas - New Mexico - Rocky Mts.

IT'S NEW
..IT'S PELCO TOO!

KING TYPES "XV" AND "PXV" SWIVELS

FOR GEOPHYSICAL AND SHALLOW WELL DRILLING

King Type "XV" Extra Volume Swivels

These light, *Extra Volume* swivels are designed especially for exploration and shallow well drilling where it is desirable to circulate larger volume of fluid than is possible with more conventional models.

Type "XV" swivels come in four sizes with oversize watercourses ranging in diameters from 1½ inches to 3 inches, ideally adapted to every shallow drilling requirement.

Type "PXV" swivels, available in three sizes, feature the same oversize watercourses up to 2½-inch diameters and are for use on rigs that use chain or cable pull-down attachments.

Other Extra-Value King Features

MOULDED RUBBER PACKING
Eliminates stuffing boxes

HARDENED WEAR BUSHING
Eliminates washpipe

PACKING & WEAR BUSHING
Easily and quickly renewed

ANGULAR-CONTACT BALL BEARINGS
Ample thrust capacity with radial stability

CLOSED HOUSING—AUTOMATIC SEALS
Complete bearing protection

BEARING LUBRICATION
By means of grease gun

ALLOY STEEL CONSTRUCTION
Safety with light weight

SHORT, COMPACT DESIGN
Less room required in mast

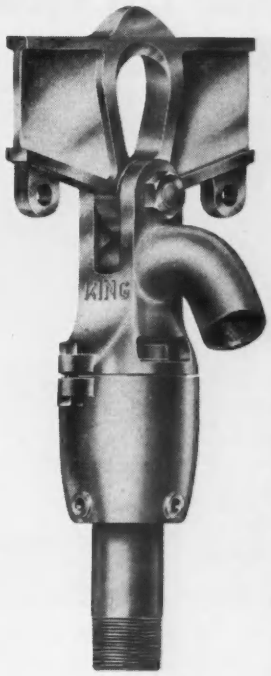
SOLD THROUGH YOUR SUPPLY STORE

Export: R. S. Stokvis & Sons, Inc., 17 Battery Place, New York 4, N. Y.

KING OIL TOOLS

210 Terminal Street **Phone WO-8013**

HOUSTON 20, TEXAS



King Type "PXV" Swivel

S & R MUD PIT

S & R Mud Pits are practically indestructible . . . with any reasonable care in loading and transporting, they will give years of service.

Standard pits are 6 feet deep, 30 feet long, 7′ 6″ wide and have a capacity of 234 barrels. Bottoms are ¼″ steel plate; sides of 3/16″ or ¼″ as specified. Heavy reinforcing . . . 3″ channel iron ribs on 36″ centers . . . provides utmost strength and rigidity along the sides. Top cross braces are above the mud level in the tank, so that the interior is absolutely free of obstructions. A clean-out plate is furnished at one end.

S & R Steel Mud Pits are skidded on 6″ H-Beams, with heavy cross-braces along the length. Skids are 8 feet wide and 33 feet long; the pits may be hauled on any standard oil field trailer. Beams are recessed at each end, so that the winch line may be snubbed or wrapped around the ends of the braces for speed, safety and convenience in loading and unloading.

Write for further information.

S & R TOOL & SUPPLY CO.

P. O. Box 1755 155 McCarty

HOUSTON 1, TEXAS

Export: 233 Broadway, New York 7, N. Y.

BASIN DRILLING CORPORATION

Operating Rotary Drilling Rigs in the Permian Basin and North Texas

Midland Tower

Phone 222

MIDLAND, TEXAS

ROBERT L. WOOD
President

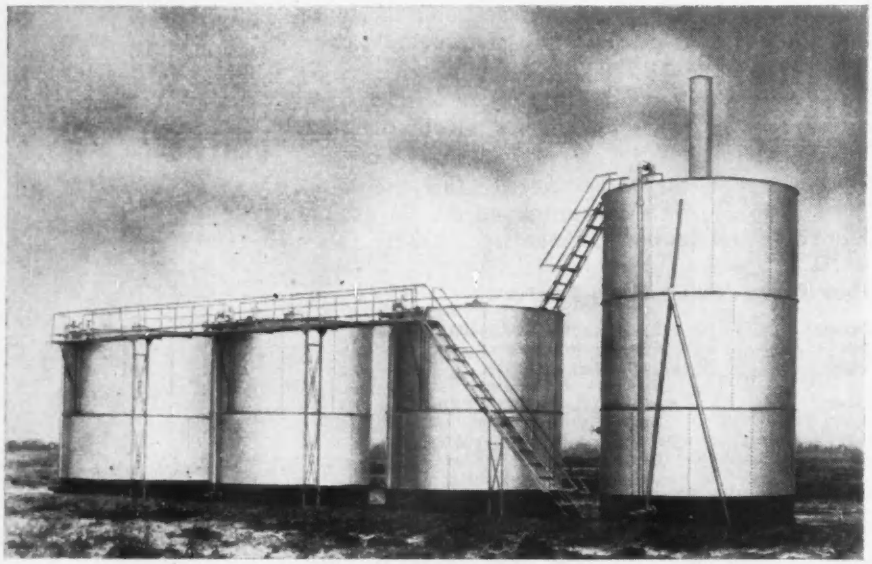
W. B. (Buck) COSTIN
Vice-President and Drilling Superintendent

Tool Pushers

HAROLD YEARGAIN
Phone 1528
Snyder, Texas

DICK LEWIS
Phone 1098 W
Graham, Texas

Proved in Service
in Oil Fields the World Over...



Three 500-barrel Butler Bolted Tanks and one 750-barrel Butler Tank, used by a drilling company of Corpus Christi, Texas.

BUTLER®

Bolted Steel OIL TANKS

- Single Tanks or Complete Batteries at Low Cost.
- Precision Formed Sheets for Fast, Low Cost Erection.
- Bolted Construction for Permanent Service or Convenient Removal to New Locations.
- Built to Do *More* than Conform to A.P.I. Specifications.
- Backed by Butler's Nearly 50 Years of Experience in Building Steel Tanks.

Call These Specialists for Prompt Service

on • Butler Bolted Tanks • Walkways • Stairways • Unit Heaters • Other Oil Field Equipment

AMERICAN PIPE & SUPPLY CO.
Denver and Rangely, Col.
Casper, Wyo.
Cut Bank, Mont

HARRY G. MILLER
El Dorado, Ark.

UNION TANK & SUPPLY CO.
Fort Worth, Houston, Odessa, Snyder, Alice, Tyler, Midland, Nocona, Texas.
Lafayette, Ruston and New Orleans, La.
Great Bend, Kans.
Tulsa, Oklahoma City, Okla.
Hobbs, N. M.

BUTLER MANUFACTURING COMPANY
KANSAS CITY, MO. GALESBURG, ILL. RICHMOND, CALIF. MINNEAPOLIS, MINN.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Franks Manufacturing Sets Up New Sales-Engineering Organization

A new field organization arrangement to facilitate on-the-spot sales, engineering, and repair service for well servicing and drilling units has been inaugurated by Franks Manufacturing Corporation.

District managers for seven areas are

pictured: (1) K. M. Lamer, (2) Albert Hastings, (3) E. R. Rudy, (4) Vern Alley, (5) R. E. Knobloch, (6) A. J. Rogers, (7) T. H. Alexander.

California is served by the Franks branch plant at Compton, under the sales direction of R. M. White (8), and the service direction of George Lewis(9).

Emsco Company Names Paul Courtney Vice President and Sales Manager

Emsco Derrick & Equipment Company has appointed Paul Courtney vice president and general sales manager, with headquarters in Houston. He will be in charge of sales for all Emsco products, except D+B sales.

J. T. Tucker continues as sales manager for the Mid-Continent, Rocky Mountain, Canadian and Eastern areas, for all products except D+B. His headquarters are in Houston.

South Texas National Bank Names Kline McGee as Oil Loan Officer

Kline McGee, formerly a vice president of National City Bank of Dallas, has been elected a vice president of South Texas National Bank, Houston, and will be the bank's principal oil loan officer.

Kline McGee

He was graduated from the University of Texas School of Business Administration in 1934, and is a graduate of the Graduate School of Banking of Rutgers University. He served four years in the Air Forces during World War II.

Everything for your Rig

at your nearby

UNITED SUPPLY STORE

Uncle Sandy SAYS

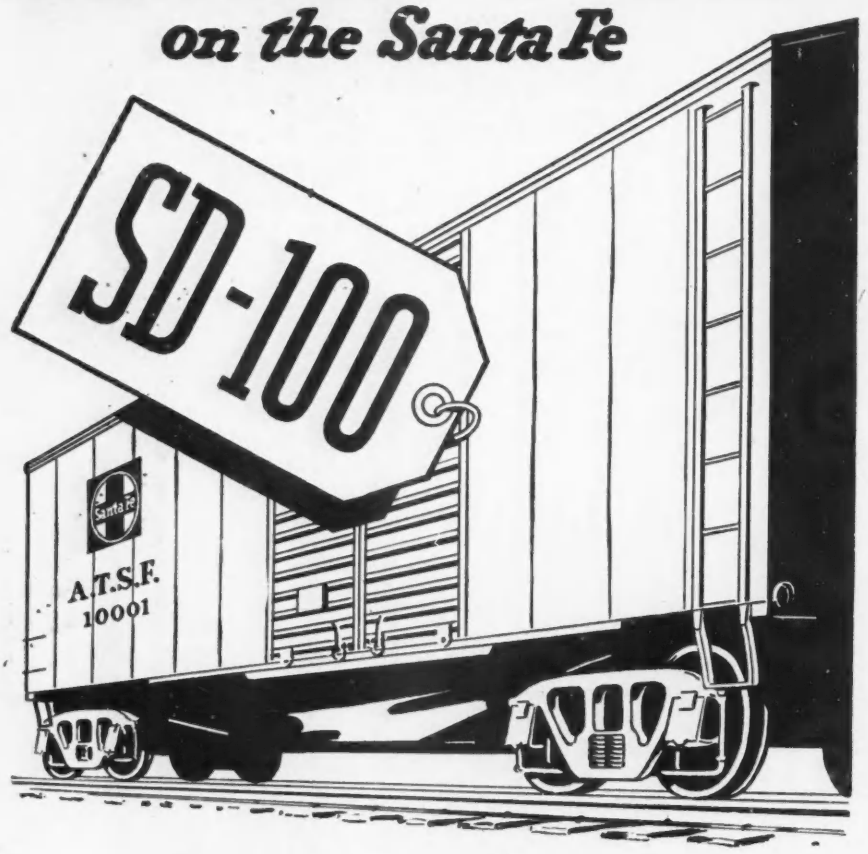
Courtesy
Service
Dependability

UNITED SUPPLY
AND *Manufacturing* COMPANY

TULSA, OKLAHOMA

Stores in Kansas, Oklahoma, Texas,
Louisiana, and New Mexico

"Red Ball"
Information Service
on the Santa Fe



This tag illustrates how cars are identified; SD is for San Diego, 100 is the checking number only this car will have while on the Santa Fe.

Where's that car of freight?
When do I get it?

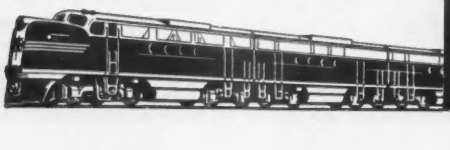
Santa Fe answers these two questions with its RED BALL INFORMATION SERVICE which tells shipper or consignee where his carload is at regular intervals when shipped over our line . . . *and tells him fast.*

Through the facilities of Santa Fe's vast private communication system extending to all Santa Fe traffic offices, information regarding your Red Ball freight is promptly placed on your desk. This information will directly benefit you in planning production or sales promotions.

Let us send you our folder describing this service. Just call or write your nearest Santa Fe Traffic Office. *It pays to "Ship Santa Fe All The Way"!*

F. H. Rockwell, *General Freight Traffic Mgr.*
Santa Fe System Lines, Chicago 4, Illinois

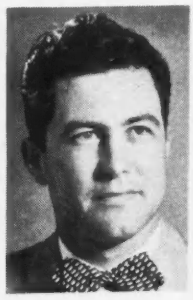
Santa Fe—*all the way*



Santa Fe

EQUIPMENT and SERVICE SUPPLIERS' NOTES

J. B. Stumm



Milton R. Jordan

Byron Jackson Company Appoints Two To South Texas, San Joaquin Areas

Milton R. Jordan, with Byron Jackson Company, Oil Tool division since 1946, has been transferred from Houston to Corpus Christi to cover the South Texas oil fields.

J. B. (Jerry) Stumm has been assigned to cover the San Joaquin Valley area, and will operate out of Bakersfield, Calif. He joined BJ in March, 1949.

United Supply Adds Three Stores In Oklahoma and Louisiana Centers

The United Supply and Manufacturing Company has added three new oil supply stores. Two are at the centers of new and extensive Oklahoma oil plays, Elk City and Ringwood. The Elk City store is managed by H. C. Thornton and the Ringwood store manager is C. W. Parker. The third new store is at Homer, La., and is managed by Joe U. Seymer.

Promotions announced by United included that of W. T. Hughes to representative at large at Oklahoma City; Don Torrance, assistant district manager for Louisiana, New Iberia, La., W. H. (Hob) Huey, assistant district manager of Oklahoma, Pauls Valley, Okla.; Richard L. Hill, field salesman at Pauls Valley; and W. L. Beckman, store manager, Eunice, La.

Cushing Is Named Manager, Drilling Equipment Sales by National Supply

The National Supply Company has appointed W. T. Cushing, Jr., manager of drilling equipment sales, replacing W. R. Ryburn, now manager of sales of seamless products for the Spang Chalfant division.

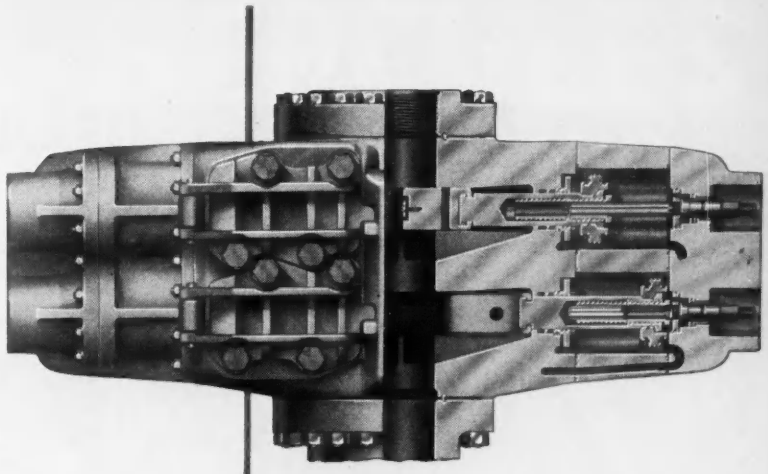
W. T. Cushing, Jr.

Cushing, a graduate of the University of Michigan, joined National Supply in 1940. After 5 years in the Engineering and Sales departments at Toledo and Torrance, Calif., and 2½ years as production equipment engineer in the Plants Products division at Houston, he was transferred to Casper, Wyo., as division engineer of the Northwest and Canadian districts. He was division sales manager for this territory at the time of his new appointment.

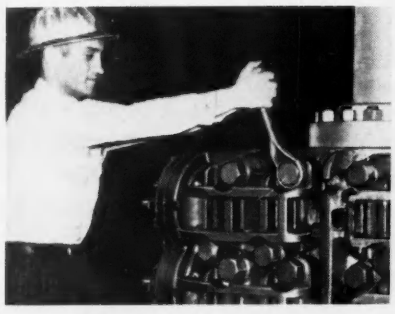
UNIVERSITY OF MICHIGAN LIBRARIES

Only 4 easy steps to change rams

in the NEW SHAFFER HYDRAULIC CELLAR CONTROL GATES

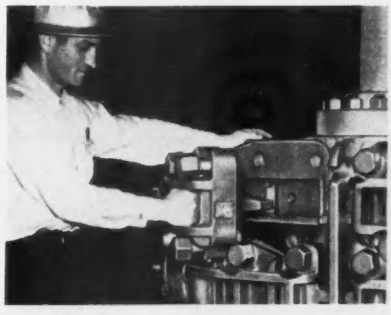


Note in this sectional view how two separate ram compartments are unitized into one compact body in the Shaffer Hydraulic Cellar Control Gate. Also note the steeply-sloped self-draining bottoms of the ram compartments . . . the direct hydraulic drive . . . and the completely enclosed design with no exterior operating parts to become jammed, damaged or corroded.



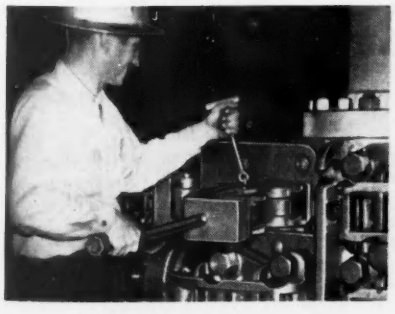
1 Unbolt two doors

in the side of the Gate. You don't even have to remove the bolts—they remain in the doors where they can't become lost.



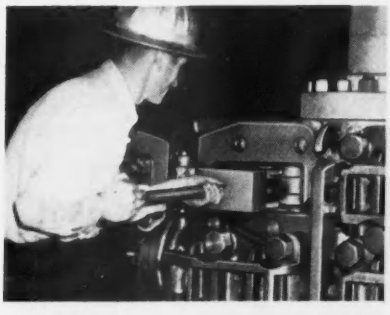
2 Swing the doors open

and pull out the ram assembly. There is nothing to loosen, unlock or disengage. The complete ram assembly slides right out.



3 Lift the rams

from the Gate and simply replace the ram blocks and rubbers with others of the desired size—a quick, simple operation.



4 Slide the ram assembly

back into the Gate, close and bolt the doors. Closing the doors automatically aligns the ram assemblies within the Gate.

With the Shaffer Hydraulic Cellar Control Gate you can make ram changes faster and simpler than in *any other* cellar control gate. And—equally important—you can make a complete ram change *whether the pipe is in or out of the hole!*

And remember this—unusual speed and simplicity of changing rams is only one of *many* vitally important advantages Shaffer engineers—pioneers in the development of high-pressure control equipment—have incorporated into Shaffer Hydraulic Cellar Control Gates. Check over the additional features outlined at right, and then get the *complete* story on these advanced Gates before you buy *any* cellar control gate equipment. No other equipment provides so much protection—in so small a space—with so many far-reaching advancements!

CHECK OVER THESE UNIQUE FEATURES, TOO!

- **UNUSUAL COMPACTNESS:** Although *two* separate ram compartments are unitized into *one* body, the overall height of the Gate, including both compartments, is only 30" in sizes as large as 13⅜" (12" Series 900). Smaller sizes are even more compact!
- **QUICK DRAINING BODY:** Note in sectional view above how the rams travel on high narrow guide ribs above the steeply-sloped bottoms of the ram compartments. Mud and sand quickly drain back into the well—no detrimental accumulations to interfere with free ram travel!
- **DIRECT HYDRAULIC DRIVE:** Also note in the view above how the hydraulic operating cylinders are directly *behind* the rams for positive action, maximum simplicity, greatest safety. There are no secondary connections between hydraulic cylinders and rams!
- **COMPLETELY ENCLOSED DESIGN:** All moving parts—even the piston rod ram shafts—are completely enclosed within the body of the Gate. There is nothing to become wedged or damaged by objects falling into the cellar—nothing to become corroded by chemical and mud drippings. Even the locking shaft is non-rising—fully protected!

And there are still other important features—all combining to make the Shaffer Hydraulic Cellar Control Gate the most advanced hydraulic gate available today. Get full details from your Shaffer representative—or write direct.

Write for your copy of the 1950 Shaffer Catalog that gives full information on Shaffer Hydraulic Cellar Control Gates and other Shaffer products.

See pages 4433 to 4496 of your 1950 Composite Catalog!

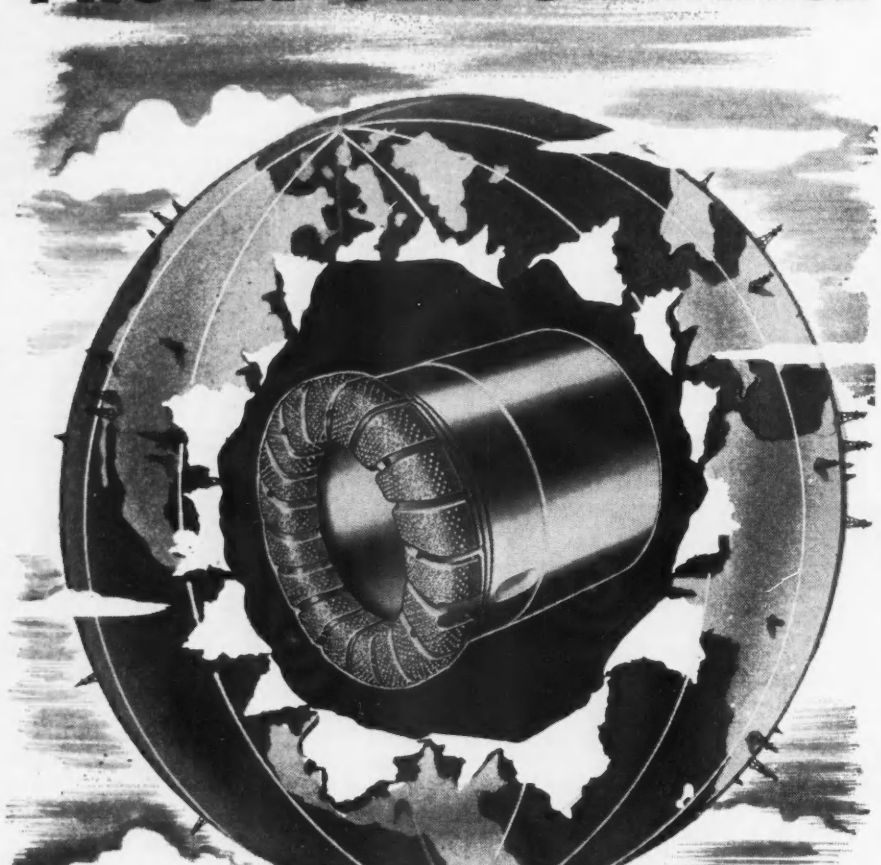
27 years OF OIL TOOL LEADERSHIP

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

SHAFFER TOOL WORKS, Brea, California • California Service Shops: Santa Fe Springs and Taft
HOUSTON, TEXAS, 6006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Street
OKLAHOMA CITY, OKLAHOMA, Acme Oil Tool Company, 1001 S. E. 29th Street
CASPER, WYOMING, Shaffer Tool Works, Post Office Box 1788
EXPORT SALES OFFICE: Shaffer Tool Works, 500 Fifth Avenue, New York, N. Y., U.S.A.

PROVED PERFORMANCE



THE WORLD OVER

◆ Faster Penetration

◆ Improved Core Recovery

◆ Less Cost Per Foot

Base Points:
Salt Lake City, Utah
Casper, Wyo., Worland, Wyo.
Hobbs, N. M., Shreveport, La.
Purcell, Oklahoma

LESS COST PER FOOT
CHRISTENSEN
DIAMOND PRODUCTS

CHRISTENSEN
DIAMOND PRODUCTS CO.

1975 SOUTH SECOND WEST • SALT LAKE CITY, UTAH • TELEPHONE 6-8738

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Whittaker Heads Globe Oil Tools; Other Executives Are Elected

Charles E. Whittaker, general manage of Globe Oil Tools Company, has been elected president of the company succeeding the late E. M. Smith. Succeeding Whittaker as vice president is Thomas R. Ashe, who has also been elected assistant general manager. Donald M. Whipple retains his post as secretary-treasurer, and John S. Goodwin continues as head of the Engineering department.

Charles E. Whittaker

Whittaker has been with the company since it was formed more than 20 years ago. Ashe was with Emsco Derrick & Equipment Company before transferring to Globe as advertising manager.

Cummins Engine Company Appoints Rocky Mountain Regional Manager

Loyd E. Williams has been appointed Rocky Mountain regional manager for Cummins Engine Company and will have headquarters in Denver for the 7-state region.

Williams, who served two years on submarines during World War II, entered the diesel field in Salem, Ill., as parts manager for the Buda Engine Sales and Service Company in 1940. He was later transferred to Denver as Northwest division manager.

Loyd E. Williams

Hyatt Appoints Cramer as General Manager, Gibbons as Chief Engineer

Raymond H. Cramer has been appointed general manager of the Hyatt Bearings division of General Motors Corporation at Harrison, N. J., succeeding the late H. O. K. Meister. Since 1924 Cramer has been with Hyatt Bearings division as tool designer, assistant chief inspector, supervisor of standards, assistant factory manager, and, since February, 1942, factory manager.

H. R. Gibbons has become chief engineer in charge of product design, research, application, and service engineering for Hyatt. He succeeds O. W. Young who assumes new duties as technical assistant to the office of the general manager.

Gibbons, who has been assistant chief engineer for the past 7 years, joined Hyatt in 1914 after graduating from Stevens Institute of Technology with a M. E. degree.

Young has been associated with Hyatt since 1915, serving as chief engineer since 1928.

UNIVERSITY OF MICHIGAN LIBRARIES

HERCULES ENGINES

POWER FOR ALL OIL FIELD NEEDS

63 Models - 3 to 500 Horsepower

GAS, GASOLINE and DIESEL

HERCULES ENGINES 3 TO 500 H. P.

GAS AND GASOLINE ENGINES

Model	Bore and Stroke	Cu. In. Displ.
Two Cylinder		
BXB	2⅞" x 3"	39
NXA	3" x 4"	56.5
NXB	3¼" x 4"	66.3
Four Cylinder		
ZXA	2½" x 3"	59
ZXB	2⅝" x 3"	65
IXA	3" x 4"	113
IXB	3¼" x 4"	133
JX4E	3½" x 4¼"	164
JX4C	3¾" x 4¼"	188
JX4D	4" x 4¼"	214
Six Cylinder		
QXA	3⅛" x 4⅛"	190
QXB	3¼" x 4⅛"	205
QXC	3⅜" x 4⅛"	221
QXLD	3 7/16" x 4¼"	236.7
JXE	3½" x 4¼"	245
JXB	3⅝" x 4¼"	263
JXC	3¾" x 4¼"	282
JXD	4" x 4¼"	320
JXLD	4" x 4½"	339
WXC-3	4¼" x 4½"	383
WXLC	4" x 4¾"	358
WXLC-3	4¼" x 4¾"	404
TDXB	4⅜" x 5¼"	474
RXB	4½" x 5¼"	501
RXC	4⅝" x 5¼"	529
RXLC	4⅝" x 5¼"	529
RXLD	4¾" x 5¼"	558
RXLDH	4¾" x 5¼"	558
HXB	5" x 6"	707
HXC	5¼" x 6"	779
HXD	5½" x 6"	855
HXE	5¾" x 6"	935

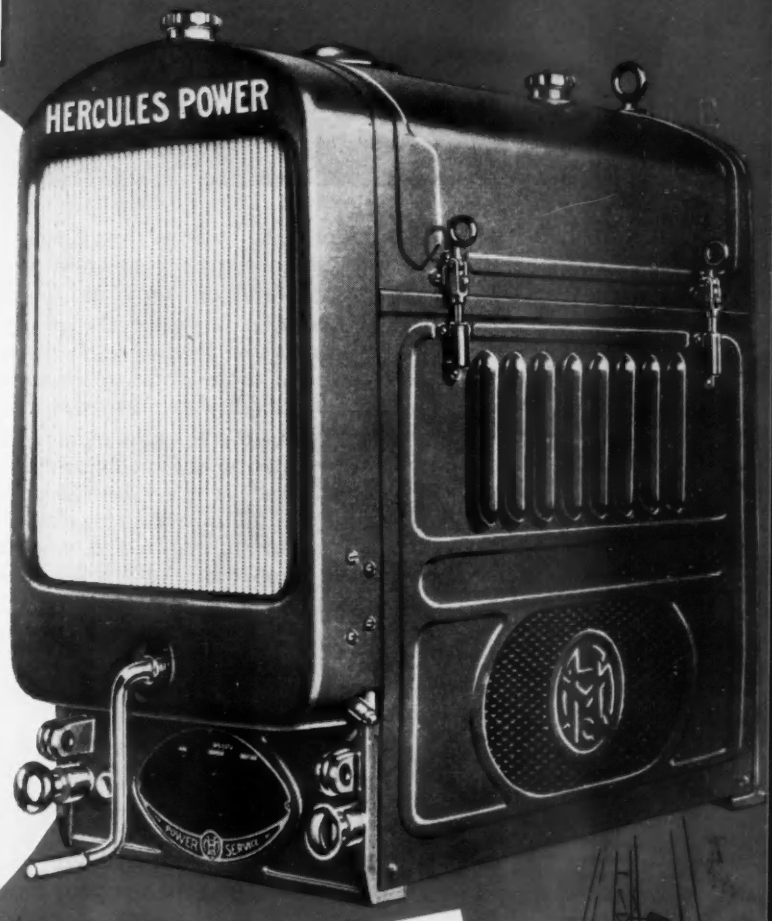
DIESEL ENGINES

Model	Bore and Stroke Inches	Piston Displ. Cu. In.
Two Cylinder		
DIXC	4" x 4½"	113.1
DIXD	4¼" x 4½"	127.5
Four Cylinder		
DIX4B	3¼" x 4"	133
DIX4D	3⅝" x 4"	166
DOOB	3¾" x 4½"	198.8
DOOC	4" x 4½"	226.2
DOOD	4¼" x 4½"	255
Six Cylinder		
DIX6D	3⅝" x 4"	249
DJXB	3½" x 4½"	260
DJXC	3¾" x 4½"	298
DJXH	3¾" x 4½"	298
DJXHF	3¾" x 4½"	298
DWXC	4" x 4¾"	358
DWXD	4¼" x 4¾"	404
DWXLD	4¼" x 5"	426
DWXLDF	4¼" x 5"	426
DRXB	4⅜" x 5¼"	474
DRXC	4⅝" x 5¼"	529
DFXB	5" x 6"	707
DFXC	5¼" x 6"	779
DFXD	5½" x 6"	855
DFXE	5⅝" x 6"	895
DFXH	5¾" x 6"	935
DFXHF	5¾" x 6"	935
Eight Cylinder		
DNX V-8B	5¾" x 6"	1247
DNX V-8C	6" x 6"	1348
DNX V-8D	6¼" x 6"	1468
DNX V-8DS	6¼" x 6"	1468

"Hercules POWER UNITS are available, equipped with any of the above engines"

The thousands of Hercules gasoline and diesel engines and power units now operating in the oil fields, point out their dependability and versatility. The Hercules line of light-weight, high-speed, heavy-duty engines consists of 15 series, 33 models, 2, 4 and 6 cylinder, 3-240 H. P. gasoline engines and 14 series, 30 models, 2, 4, 6 and 8 cylinder, 12-500 H. P. diesel engines.

Of particular interest to oil field power users is the Hercules JX4 series gasoline engines. (Power Unit shown at right.) This series is an example of the sound engineering principles and the engine building "know-how" incorporated in all Hercules Engines. Recently developed for power unit use, the JX4 series has already won wide acclaim by many oil field users in all phases of operation—pumping, drilling, exploration and production. Perhaps the JX4 series is the answer to your power needs. If not, other Hercules Engines are. Write the factory or sales and service branch nearest you for full details on the JX4 series or other Hercules Engines.



MODEL JX4D
4 cylinder gasoline engine
4" bore x 4¼" stroke
214 cubic inch displacement
53.5 H. P. @ 1800 R. P. M.

FACTORY SALES AND SERVICE BRANCHES:
Los Angeles, Calif., Salem, Ill., Houston, Odessa & Kilgore, Texas

KELLETT INDUSTRIES
740 S. Claiborne
New Orleans 13, Louisiana

PAKCO COMPANY
2427 E. 37th Street
Los Angeles 11, California

OILFIELD MOTOR SERVICE
Alice, Texas

HERCULES-LUPFER ENGINE SALES CO.
124 North Boston
P. O. Box 607, Tulsa, Oklahoma

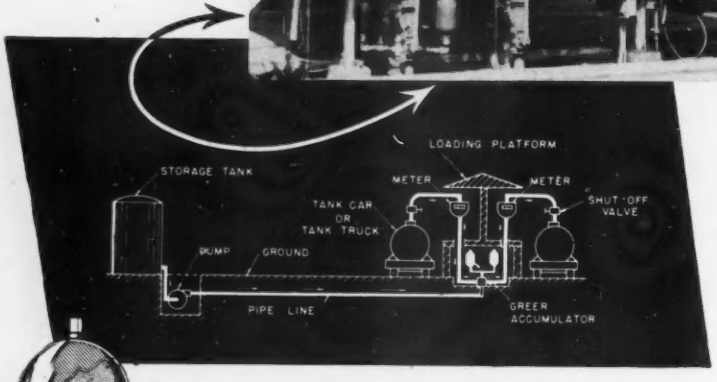
LIGHTBOURN EQUIPMENT CO.
511 S. Industrial Blvd.
Dallas 2, Texas

SUPERIOR IRON WORKS & SUPPLY COMPANY INC.
Box 1800, Shreveport, Louisiana

FOOD MACHINERY & CHEMICAL CORP.
Box 671, McAllen, Texas

HERCULES MOTORS CORPORATION, Canton, Ohio, U.S.A.

GREER ACCUMULATORS
Suppress Line Shocks – Prevent Line Breakage – Protect Meters



United States Patents Under Olear Licenses

THOUSANDS of bulk stations throughout the nation are used in the distribution of petroleum products such as gasoline and fuel oil for local consumption.

A typical bulk station is shown above and consists of a series of storage tanks and loading racks. Due to the highly inflammable nature of these products, the storage tanks must be located at considerable distances from the loading racks.

Fuel is pumped to the loading truck and when the required quantity shows on the meter the supply is immediately cut off by a quick-acting valve. This sudden stoppage in flow sets up hydraulic line shocks through the system which unless properly suppressed or eliminated often cause damage to meters, and possible leakage or breakage of the pipeline and fitting.

Greer Accumulators in actual installations, one of which is shown above, suppress these line shocks and minimize or in many cases completely eliminate line failure due to hydraulic shock.

If you have experienced line failures you know how costly they can be. An inexpensive accumulator will save you many times its cost in a short period of time.

Our Bulletin 600 describes in detail the use of accumulators to suppress hydraulic shock. Write for your copy today on your company letterhead.

SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES

YOUR SYMBOL OF SERVICE

GREER
HYDRAULICS INC.
454 EIGHTEENTH ST., BROOKLYN 15, N. Y.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

National Supply Export Promotes J. P. Dankel to Assistant Treasurer

National Supply Export Corporation has appointed John P. Dankel as assistant treasurer. Formerly credit and traffic manager for the Export Corporation, and also export credit manager for the Superior Engine division of The National Supply Company, he will continue to supervise these functions.

Dankel joined National Supply Export in 1922.

John P. Dankel

Mullen Directs Flight Operations For Aero Service Corporation

Joseph P. Mullen, Jr., has been appointed director of flight operations for Aero Service Corporation, Philadelphia. Mullen will head the company's pilots and photographers, directing their work in mapping activities all over the world.

Mullen joined Aero's mapping staff in 1946, after 4 years service with the Air Force.

Baroid Ads Win High Honors

In the 1950 industrial advertising competition conducted by the National Industrial Advertisers Association, the advertising campaign of the Baroid Sales division, National Lead Company, was awarded second place in the Petroleum division, a close runner-up to the first-award winner, Standard Oil Company of California.

Emsco Adds Canadian Pump Sales

Emsco Derrick & Equipment Company has appointed Oil Equipment, Ltd., as general distributor for slush pumps and spare parts in Western Canada. New pump sales agents are Dominion Oilfields Supply Co., Ltd., Rocky Mountain Supply Company, Ltd., and Farmington Supply Company.

Mallard Supply Opens New Store

Mallard Supply Company, Odessa, Texas, has opened a new store at Post, Texas, with Jim Furry as store manager and V. V. McGrew as field salesman.

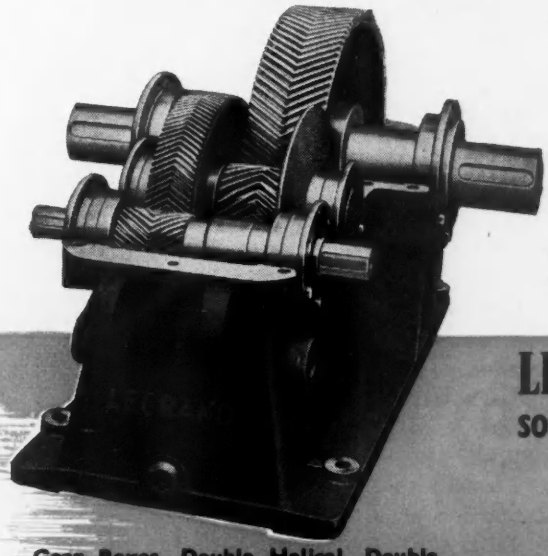
Christensen Names Division Manager

R. L. Poundstone has been named division manager for Christensen Diamond Products Company in Oklahoma City, with offices at 625½ N.E. 23rd Street. He was formerly with The Carter Oil Company. Kenneth Lewis is in charge of the company's office in Pauls Valley, Okla.

National Tank Opens Wichita Office

National Tank Company, Tulsa, has opened an office at Wichita, Kansas, with R. H. Brooks, Jr., district sales manager, in charge.

LE GRAND Pumping units



Gear Boxes, Double Helical, Double Reduction, built to A.P.I. Specification.

LE GRAND'S units range from 3,000 lbs., Polished Rod Load with intermediate sizes up to 31,000 P.R.L.

LE GRAND'S manufacture in England under licence the products of OIL CENTER TOOL CO., Houston, Texas, U.S.A.

LE GRAND SUTCLIFF & GELL LTD

SOUTHALL, MIDDLESEX, ENG. ROCHESTER, KENT, ENG.

Telephone: Southall 2211 Telegrams: Legrand, Southall.
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OILFIELD EQUIPMENT MANUFACTURERS & FOUNDERS

Safe—Comfortable—Dependable

WILLSON

Gas Masks For Every Hazard

WILLSON*

Dependable Products Since 1870

*T.M. Reg. U.S. Pat. Off.

For effective protection against acid gases, organic vapors, carbon monoxide, fumes, mists, smokes and similar hazards, there is a WILLSON Gas Mask approved by the U. S. Bureau of Mines. They have been designed with every consideration for worker safety and comfort. A selector table and complete information on various types is included in our new catalog. Ask our nearest distributor for a copy—or write direct to WILLSON PRODUCTS, INC., 202 Washington Street, Reading, Pa.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

J. E. McCarthy

R. M. Greene

Clark Bros. Company Assigns Two in Turbo-Machinery Division Offices

Clark Bros. Company, Inc., announced the transfer of J. E. McCarthy to the Houston office as sales engineer in the Turbo-Machinery division. He is succeeded as manager of the Turbo-Machinery Technical Service department by R. M. Greene.

McCarthy, a graduate of Cornell University, has been with Clark since 1946.

Greene is a graduate of the School of Mechanical Engineering of Cooper Union, and was previously in the Service department of Foster Wheeler Corporation.

Iverson Supply Announces Changes In Oklahoma and Texas Sales Staffs

Glenn Wilson has been added to the Tulsa sales staff of Iverson Supply Company. He had formerly been with Bovaird Supply Company. Jay Morgan, previously with Jarecki Manufacturing Company, has joined the Houston city sales staff.

R. S. Searls, Jr., has been promoted from store manager of the Odessa, Texas, store to field salesman in the Odessa area. David Crichton, Jr., succeeds Searls as store manager.

M. J. Hunter has been transferred from the Okmulgee store to the new Snyder, Texas, store as assistant division manager in charge of the Synder area. Henry F. Oliver, Midland, Texas, is West Texas division manager.

J. W. Wright has been transferred from Kermit, Texas, to Snyder as store manager. W. D. (Bill) Barnett, formerly with Bovaird, has joined Iverson as field salesman at Snyder.

Long New Assistant at Oil Base

Jack Long has been made assistant general manager of Oil Base, Inc., relieving George Miller who will devote full time to management and distribution. Formerly in sales, Long will divide his time between management and sales of Black Magic oil base drilling fluid, White Magic oil emulsion mud, and other mud conditioning products.

New York Firm Names Tilley

Frank E. Tilley has been named manager of advertising and sales promotion for New York Belting & Packing Company, Passaic, N. J. Tilley received his master of science degree from Columbia University. He joined New York Belting & Packing in 1939.

Only RECTORHEADS HAVE THESE ADVANTAGES . . .

Speed . . . Safety . . . Simplicity

Rectorhead casing and tubing heads, alone, have these advantages which mean speed in making-up, safety against fire, freedom from leaks, and no "blind spots" for corrosive action, simplicity in setting and sealing pipe strings.

1. **WELDED SEAL.** Floating welding ring is easily and securely welded to any grade of pipe by regular field welders, using welding procedure.

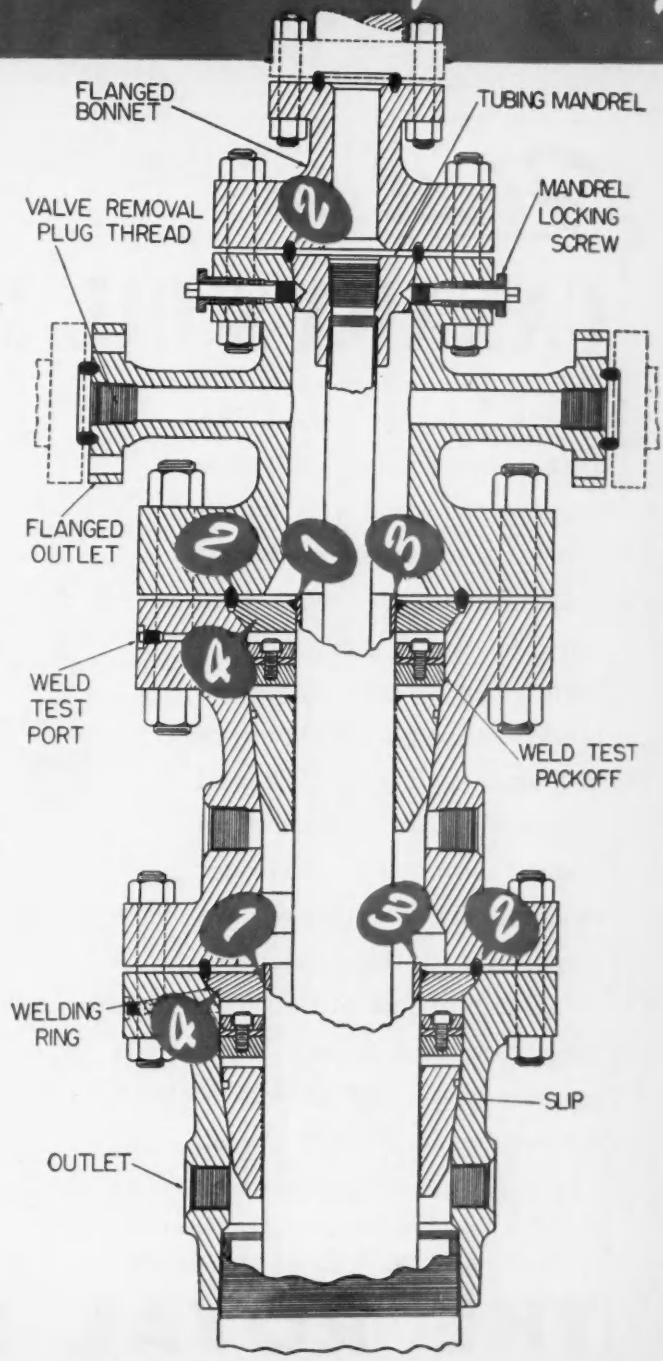
2. **API RING GASKET.** Patented seal-suspension to body completes the seal in its groove at the junction of suspension member and head body.

3. **MINIMUM PROJECTION ABOVE TOP OF HEAD.** Pipe protrudes a minimum amount above the top flange of the head in which it is suspended. This provides no interference for attachment of blowout preventer or subsequent heads.

4. **SEALING ELEMENT INDEPENDENT OF SLIPS.** Neither the welding ring nor weld are subjected to opposing forces (flange bolts pulling against heat expansion) during or after the weld.

PLUS: **In addition, Rectorhead seals are immune to corrosion inhibitors . . . fireproof . . . free of the danger of leaks due to freezing . . . require no packing replacement . . . have no complicated packing arrangements to install.**

Call your nearest Rector Representative, or write for catalog.



RECTOR WELL EQUIPMENT CO., INC.

FORT WORTH, TEXAS

Fort Worth Plant . . . . . 1100 N. Commerce St.
Houston Plant . . . . . 2215 Commerce St.

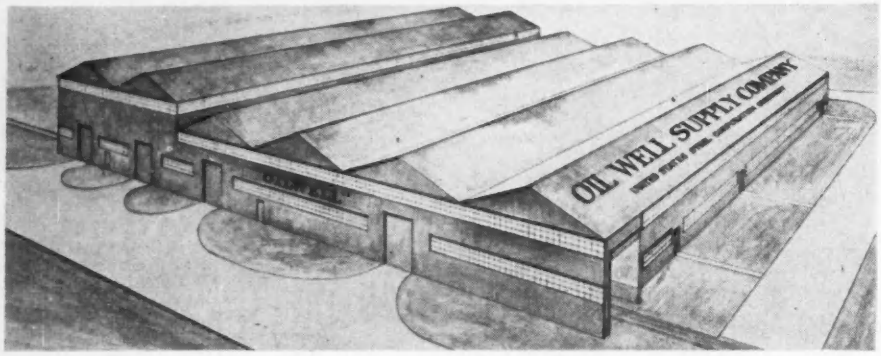
Representatives in All Active Fields

RECTOR

RECTORHEAD

MAKING THE OIL INDUSTRY SAFER!

ASSOCIATION OF WELL HEAD EQUIPMENT MANUFACTURERS CERTIFIED



Engineer's drawing shows Oil Well Supply Company's central modification center and warehouse as it will appear when completed at Garland, Texas, about October 1. The Garland unit, which will be within 24 hours shipping distance of every major Southwestern oil field, will supply spare parts and will handle modification of equipment to specific customer needs.

First in

CANADA'S OIL FIELDS

Alberta today is one of the most active areas of oil exploration in the world with almost double the number of producing wells and output than a year ago. The Royal Bank, with 57 branches in Alberta, opened its branch in the oil field territory in Turner Valley in 1928 and followed with branches in Leduc, Devon and Redwater as development expanded. We know the oil fields and the men responsible for the development.

Our branches in Calgary and Edmonton can supply up-to-the-minute and factual information for operators, equipment manufacturers and all who seek sound advice on establishing connections in Western Canada.

If you have any interest in Canada's oil fields, address your enquiry to:

E. B. Durham, *Supervisor* The Royal Bank of Canada, Calgary, Alberta

We do not provide information on oil securities

THE ROYAL BANK OF CANADA

Over 735 branches in Canada, the West Indies, Central and South America. New York, London, and Paris. Head office, Montreal.

Canada's "Oil" Bank ASSETS EXCEED $2,334,000,000

Burt Is Appointed Sales Manager Of Ryerson Steel Chicago Plant

Roland W. Burt has been appointed sales manager of the Chicago plant of Joseph T. Ryerson & Son, Inc., steel distributors. He succeeds Thomas Z. Hayward, former assistant general manager of sales and acting sales manager of the Chicago plant who has been promoted to general manager of sales.

Burt joined Ryerson in 1923, and most recently has been head of the Tubular Products division.

Dunaway Named Credit Manager For Ideco Supply Stores Division

A. A. (Judge) Dunaway has been appointed credit manager for the Supply Stores division of the International Derrick and Equipment Company.

A. A. Dunaway

A graduate of Louisiana Polytechnic Institute, Dunaway has spent more than 16 years in the Mid-Continent and Gulf Coast areas as a sales representative and credit manager. He served with the U. S. Coast Guard during World War II. Since the end of the war he has held the position of district credit manager for the Continental Supply Company.

Oil Well Supply Names Managers, Assigns Field Representatives

Jimmy Lester Brown has been named manager of Oil Well Supply Company's Denver City, Texas, store. He was formerly field representative at Hobbs, New Mexico.

Tommy W. Casey is the new manager of the El Dorado, Ark., store, succeeding Frank W. Bruner, Jr., who has transferred to Shreveport as district representative. Casey had been field representative.

Paul E. Hunter, formerly manager of the Franklin, Penn., store, is manager of the Clarksburg, W. Va., store.

H. C. Smith Appoints Ankney

Appointment of Jack Ankney as sales representative in Cody, Wyoming for H. C. Smith Oil Tool Company, has been announced by Ronald C. Smith, general sales manager. Ankney has been actively engaged in sales work in Sussex and Glenrock fields.

WILSON SUPPLY COMPANY

Announces

it has Acquired the Distribution

of

BRYAN

GAS LIFT EQUIPMENT

WILL NOW BE KNOWN AS

WILSON-BRYAN GAS LIFT EQUIPMENT

In order to give the oil industry a more complete service on gas-lift equipment the Wilson Supply Company has added Wilson-Bryan Gas-Lift Flow Valves to their other line of gas-lift equipment.

The Wilson Supply Company, a pioneer in the field of gas lifting, recognizes the fact that production problems vary from field to field, and that no single type of gas-lift equipment will efficiently produce all wells. However, with their expanded line of equipment, the Wilson Supply Company feel it is now in a position to equip wells with gas-lift valves that will produce from high or low fluid levels, large or small volumes, and reduce production costs to a minimum.

Among recent developments in Wilson-Bryan Gas-Lift Valves are:

(1) A method of producing wells with bellows type flow valves whereby the highest gas pressure is utilized at the lowest valve in the tubing string. Rate of production is controlled by selective operating depth and a clock controlled surface intermitter.

(2) A system whereby a series of bellows type flow valves can be removed from the tubing string without pulling tubing.

(3) A bellows valve that is directly controlled by fluid head in the tubing. This valve operates independent of casing pressure and does not require a clock controlled surface intermitter.

For latest developments in Gas-Lift Equipment— contact your Wilson Supply Store, or write

WILSON SUPPLY COMPANY

1412 Maury St.
HOUSTON, TEXAS

BRYAN GAS LIFT EQUIPMENT CO.—Ft. Worth, Texas

Wallace Robertson, Dist.
VICTORIA, TEXAS

•

Henry Dear, Dist.
BAKERSFIELD, CALIF.

Photo courtesy: Cliff Hyde Flying Service, Houston

The F-A-S-T Four-Passenger PIPER PACER

The development of the Pacer by Piper—the world's leading manufacturer of personal planes—is big news to the oil industry where fast-moving competition and developments require the flexible transportation possible only by company plane.

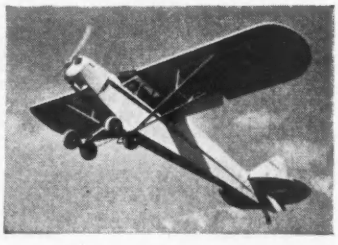
Here for the first time is a two-mile-a-minute airplane priced for less than a fine car. It carries four people in quiet comfort at less cost than for bus fare —or it can haul a quarter-ton of freight. It has famous Piper easy-to-fly features and can fly from rough, unprepared fields.

Now for the first time many firms can enjoy with the Pacer all the advantages of a company-owned plane to increase sales coverage, cut travel time between jobs or speed repair parts. Investigate today the time and money-saving Piper Pacer. Write for brochure.

LEARN TO FLY WHILE YOU TRAVEL

Rent a Piper from your Piper dealer for business trips and he'll teach you to fly at *no extra cost* en route! No simpler way to learn to fly; no more pleasant way to travel! Write for "Learn-As-You-Travel" brochure. Dept. WO-1.

ALSO THE SUPER CUB



Can take off and land in less than 50 yards. Optional tandem-wheel gear permits very rough field landings. Ideal for pipe-line patrol, general utility work in fields. Carries two passengers or 500 pounds of cargo. 90 or 108 horsepower. Cruises better than 100 mph. Prices start at $2,795. Write for Super Cub brochure.

PIPER AIRCRAFT CORP., LOCK HAVEN, PA.

"TRAVEL FASTER, CHEAPER BY PIPER"

EQUIPMENT and SERVICE SUPPLIERS' NOTES

F. J. Heaslip

O. O. Lewis

Lewis and Heaslip Are Elected Fairbanks, Morse Vice Presidents

Fairbanks, Morse & Company directors have elected O. O. Lewis vice president in charge of sales, and F. J. Heaslip, vice president in charge of purchases and traffic.

In 1908 Lewis joined the company as a clerk, and in 1948 he was appointed sales manager. He is also a director of the firm.

Heaslip was first employed by Fairbanks, Morse in 1927 as a buyer in the Purchasing department. He was made purchasing agent in 1935 and director of purchases in 1942. He has been a director several years.

Lincoln Electric Company President Honored by Ohio State University

James F. Lincoln, president of The Lincoln Electric Company, was among the five distinguished Americans who received honorary degrees from Ohio State University. The University conferred on Lincoln, a 1926 electrical engineering graduate, the degree of doctor of science.

Lincoln, the man in whose honor the James F. Lincoln Arc Welding Foundation was created, is a fellow in the American Institute of Electrical Engineers, member and director of the National Electrical Manufacturers Association, member of the American Welding Society, the American Society of Mechanical Engineers, and the Cleveland Engineering Society.

$1 Million Expansion Program Begun At Goodyear Rubber Company Plant

A $1 million expansion and improvement program is under way at Goodyear Tire and Rubber Company's St. Marys, Ohio, plant. Located directly opposite existing plant buildings, a new addition to house molded and extruded goods manufacture, warehousing and engineering services will have 112,000 square feet of floor space. The structure will be one story, monitor type (raised roof portions to improve lighting and air circulation), constructed of concrete blocks and steel.

Improvement to the present plant includes addition of new boilers to the power house.

E. L. Decker Makes European Trip

E. L. Decker, president of Martin-Decker Corporation, has been in Europe on a 3 months' business trip. His schedule called for studying weight indicator needs and conferring with oil men in London, the Hague, Germany, France, and Italy.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

McCullough Tool Company Appoints Miedecke Avenal Branch Manager

S. F. Miedecke, former assistant manager, has been named branch manager of McCullough Tool Company's Avenal, Calif. branch, I. J. McCullough, president announced.

S. F. Miedecke

Miedecke, a "pioneer" in the Kettleman Hills area, has had more than 8 years of practical oil field experience with all McCullough tools and services. He replaces O. K. Stephens, who resigned to enter private business.

U. S. Steel of Delaware Elects Vice President and Board Member

Lewis M. Parsons, formerly assistant to vice president-sales, has been elected a vice president, director and member of the executive committee of United States Steel Corporation of Delaware. He will continue to be at Washington, D. C.

Lewis M. Parsons

Parsons, a graduate of Massachusetts Institute of Technology, joined U. S. Steel in 1945. He entered the steel industry in 1919.

Appointed Dealer for Chrysler

Stewart & Stevenson Services, Inc., Gulf Coast distributor of Diesel engines, has been appointed a franchise dealer for Chrysler marine engines. Complete parts and service, as well as the new line of Chrysler marine engines will be available at all branches.

Lucey Secretary Is Chosen

William F. Latting, Tulsa, has been named secretary of Lucey Products Corporation. He was formerly director of personnel and employe relations with Barnsdall Oil Company.

Kobe Sets Up New Headquarters

Kobe, Inc., has established its Rocky Mountain headquarters at Casper, Wyo., with Maury Anderson, district representative, in charge. Offices had previously been maintained at Rangely, Colo.

Richards-Conant Is Representative

Richards-Conant, Denver sales and engineering firm, will represent United Centrifugal Pumps, a division of United Iron Works, in New Mexico, Wyoming, Colorado, Montana, and in western South Dakota, Nebraska, and Kansas.

The Bear Facts About Heaters!

Anchor heaters give you fast, safe, fume-free heat when and where you want it. They require no vents. The patented air-cooled Anchor burners provide uniform mixture of gas and air for proper combustion.

These portable, sturdy, low cost gas heaters are a sound investment in improved working conditions and better health for your men.

Anchor Heaters are furnished for butane, propane, natural or manufactured gas. Specify gas to be used when ordering.

Model 20 . . . 150,000 BTU Capacity; Diameter: 24"; Height: 48"
This is the model you need for warehouses, shops, supply stores . . . wherever there is a large area to be heated.

Model 15...50,000 BTU Capacity Diameter: 19"; Height: 35"
This is ideal for derricks, field offices, large locker and change houses and other medium size areas where warmth is essential.

Model 10...25,000 BTU Capacity Size: 5-1/2" x 11" x 24"
This model is perfect for lease houses, pumpers' shacks, tool and change houses, etc. It is made of heavy gauge steel and has three Anchor L-1 burner heads.

Be ready for cold weather by ordering your Anchor Heaters from your supply store now.

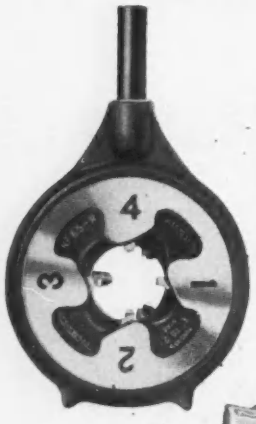
WELL EQUIPMENT MFG. CORP.
Subsidiary of Chiksan Company
HOUSTON 1, TEXAS
Exclusive Sales Representative Outside Mid-Continent Area
CHIKSAN COMPANY
Brea, Calif. Chicago 3, Ill. Newark 2, N. J.
Export Sales: CHIKSAN EXPORT COMPANY, Brea, Calif. Newark 2, N. J.

WECO
Manufacturers and Distributors of Oilfield, Refining, Marine and Industrial Equipment

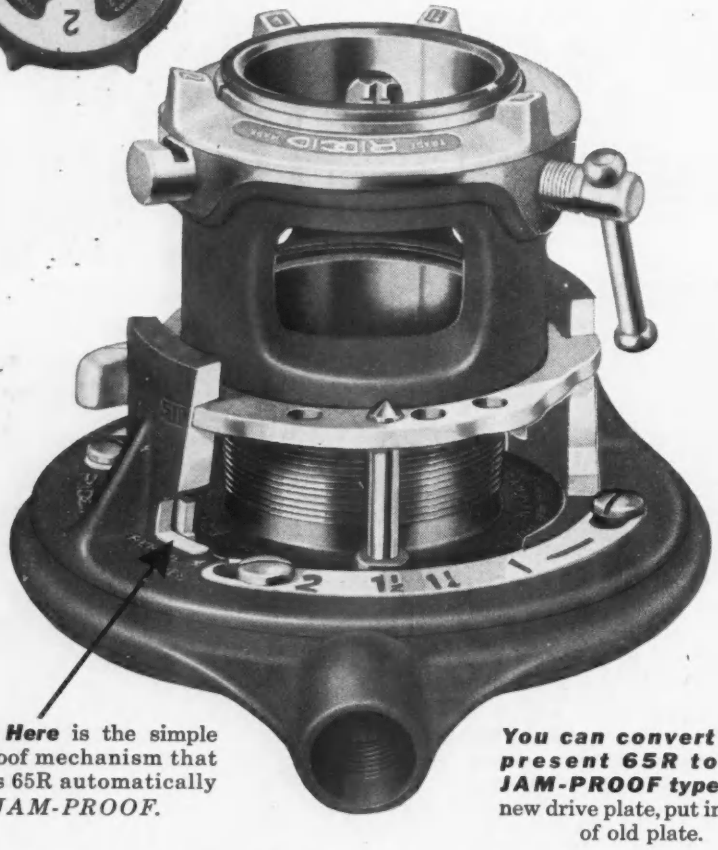
NOW New Streamlined RIDGID 65R

Die Stock that WON'T JAM

while threading with power drive or by hand



New *JAM-PROOF* drive plate automatically kicks out driving ratchet pawl when standard length thread is cut.... You don't have to watch it—lead screw can't jam on workholder.



Right Here is the simple foolproof mechanism that makes 65R automatically *JAM-PROOF.*

You can convert your present 65R to new JAM-PROOF type — buy new drive plate, put in place of old plate.

All other RIDGID 65R features remain the same

Perfect threads on 1" to 2" pipe with 1 set of high-speed steel dies—sets to pipe size in 10 seconds—mistake-proof self-centering workholder sets instantly—and now it's *JAM-PROOF.*

Buy new JAM-PROOF RIDGID 65R at your supply house

RIDGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL CO. • ELYRIA, OHIO

EQUIPMENT and SERVICE SUPPLIERS' NOTES

A-1 Bit & Tool Company Assigns Trimble to West Texas Branch

Harry C. Trimble has established Headquarters at 1106 West Indiana Street, Midland, Texas, to direct sales and service of A-1 Bit & Tool Company products. A former driller in Kansas, Oklahoma and Mississippi, Trimble joined A-1 as a service tool operator in June, 1946, and has since been district sales manager in Houma, La., Brookhaven, Miss., and Calgary, Alberta, Canada.

Harry C. Trimble

Howell Elected Vice President and Treasurer of United States Steel

Max D. Howell, 62, assistant to president, vice president, secretary and treasurer of United States Steel Corporation of Delaware, has been elected vice president and treasurer of United States Steel Corporation.

Howell was educated at the University of Michigan, and began his business career in 1912. He was vice president of Chemical Bank and Trust Company, New York, from 1930 until 1937, when he joined U. S. Steel as vice president of Carnegie-Illinois Steel Corporation at Pittsburgh.

Howell replaces Gordon L. Edwards, retired. Edwards joined U. S. Steel when it was formed in 1901.

C. B. Vernooy, former comptroller of the Geneva Steel Company, Utah subsidiary, was appointed assistant comptroller. He went to work for American Steel & Wire Company in 1919 and moved to Geneva Steel in March, 1948.

Paul C. Van Cleave was named vice president—sales of the U. S. Steel Supply Company, replacing Marcus J. Aurelius, who has been made vice president—sales of Columbia Steel Company.

Parnell and Elmdahl Are Appointed To Core Lab's Board of Directors

Following acquisition of controlling interest by a group of employes, Core Laboratories, Inc., Dallas, announced the appointments of Ralph W. Parnell, Shreveport, and Ben A. Elmdahl, Houston, to its new board of directors. Other members of the board include John D. Wisenbaker, Dallas, president of the company, and 2 representatives of Case-Pomeroy, New York. The latter organization formerly held full ownership of Core Lab.

Coinciding with these appointments was an election of Rufe S. Bynum, Midland, and J. W. Barbour, Jr., Oklahoma City, as vice presidents, and Clair C. Miller, Dallas, secretary and treasurer.

Welex Jet Opens Snyder Office

Welex Jet Services, Inc., has opened a new field station at Snyder, Texas, with J. E. Sherrod as operations manager. Sherrod joined Welex in 1948 and worked from the field station at Odessa until promoted to manager of the Snyder station.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Stevenson and Boyer Made Members Of the Board by Cooper-Bessemer

Ralph L. Boyer, vice president and chief engineer of Cooper-Bessemer Corporation, and William E. Stevenson, president of Oberlin College, were elected members of the Cooper-Bessemer board of directors.

An authority in the diesel, gas engine, and compressor fields, Boyer is a graduate of Ohio State University with a Master's degree in mechanical engineering. He started his design career with Cooper-Bessemer in 1926, and, in 1947, was made vice president and chief engineer. He has recently been associated with such developments as the gas-diesel engine, Turboflow, and the supercharging of 4-cycle spark-ignited gas engines.

A graduate of Princeton, Stevenson attended Oxford University as a Rhodes Scholar, receiving his M.A. degree in 1925. During World War II he was American Red Cross delegate to Great Britain, North Africa, and Italy. Prior to becoming President of Oberlin College, he was a partner in the New York law firm of Debevoise, Stevenson, Plimpton & Page.

Chicago Industrialist Elected Director of Dresser Industries

Henry P. Isham, president of Clearing Industrial District, Inc., Chicago, and a director of a number of leading banks and corporations, has been elected a director and a member of the executive committee of Dresser Industries, Inc.

Henry P. Isham

Isham, a graduate of Yale University, served in World War II as chief of purchase, termination and renegotiation policy of the Chicago Ordnance district, Army Service Forces.

J. K. Sutter Appointed Pittsburgh District Manager by Spang-Chalfant

J. K. Sutter, Boston sales representative for the Spang-Chalfant Division of The National Supply Company since 1944, has been transferred to Pittsburgh, as district manager.

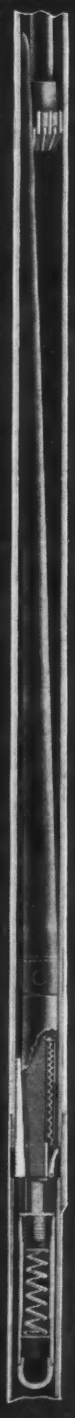
Sutter joined Spang-Chalfant's sales department in 1927 and later worked in the New York and Memphis sales offices. He succeeds C. J. Ramsburg, Jr., who has been promoted to the position of manager of welded product sales.

Lowery and Dean, Salesman for Continental Supply, Transferred

H. E. (Ike) Lowery, sales representative for The Continental Supply Company at the New Orleans district office, has been transferred to the district office in Houston as manager of drilling equipment sales for the Gulf Coast.

John J. Dean, former salesman for Continental at the Houston district office, has been transferred to Harvey, La., as store manager.

KINZBACH Whipstocks and Mills-FIRST with oilmen for 24 years



Leading oil operators the world over use Kinzbach Whipstocks for side-tracking, straightening and directional drilling operations. They can be set at any depth, requiring no support for the bottom. Positive setting slips prevent slipping or turning in hole. They can be oriented to mill out in any direction. Patented hinge arrangement assures that top of Whipstock will lie close against pipe walls at all times, permitting easy passage of drilling tools. Setting trigger always locates whipstock between couplings so window will be within one joint. Available in all popular sizes of casing.

Type "A" Mill Type "D" Mill Type "H" Mill Type "I" Mill

Carefully heat-treated high-speed tool steel inserts from the cutting blades in Kinzbach Milling Tools. These inserts, set at most efficient cutting angles in properly shaped, high quality steel bodies provide unequalled cutting action and a uniform depth of cut.

KINZBACH TOOL CO., INC.
P. O. BOX 277 • HOUSTON, TEXAS

KINZBACH TOOL CO INC

Export Office:
74 Trinity Place,
New York, N. Y.

WORLD OIL'S Trading Post

CLASSIFIED ADS

SERVICES · PERSONNEL · USED EQUIPMENT

RATES: Regular Classified (undisplayed) set in this size type: 10 cents per word. If Box Number is to be used count an additional six words. Replies forwarded without charge. Situation Wanted: 5 cents per word. Display advertisements, set in suitably larger type with ruled border: $9.00 per column inch per insertion. Situation Wanted: $4.50 per column inch. **All classified ads payable in advance.** 10% Discount if 3 or more insertions are ordered at one time. **COPY DEADLINE:** 5th of month preceding date of issue. Send copy and checks to: Trading Post Section, World Oil, P. O. Box 2608, Houston, Texas.

LEASES, DRILLING, ACREAGE, ETC.

NOTICE OF SALE OF OIL, GAS AND MINERAL LEASES

Pursuant to the provisions of Chapter 150 of the General and Special Laws of the State of Texas, passed by the 45th Legislature at its Regular Session, the Board of Directors of the Agricultural and Mechanical College of Texas hereby offers for sale, at public auction in the Office of the Comptroller, Room 3, Administration Building, College Station, Texas, at 10 a.m. on Tuesday, September 26, 1950, the oil, gas, sulphur and other mineral leases on approximately one thousand (1,000) acres of land, occupied by Substation No. 7 of the Texas Agricultural Experiment Station, located near Spur, in Dickens County, Texas. The right is reserved to reject any and all bids and to withdraw any lands advertised for lease. This land consists of parts of Sections No. 222, 246 and 247 which for the purpose of these leases are divided into blocks as described below:

Block No.	Description	No. of Acres (More or less)
1	N. W. ¼ of Section 222	169.31 acres
2	N. E. ¼ of Section 222	169.31 acres
3	South ½ of S. W. ¼ of Section 247	82.91 acres
4	S. E. ¼ of Section 247	163.37 acres
5	S. W. ¼ of Section 246	165.83 acres
6	S. E. ¼ of Section 246	165.21 acres
7	All of the land on which the mineral rights are owned by the State of Texas in the N. E. ¼ of Section 246	84.03 acres

Separate bids shall be made for each block. Only cash bids will be considered. Each lease will be for a term of five years or as long thereafter as oil, gas, sulphur or other mineral is being produced in paying quantities therefrom. Each lease will carry a royalty of one-sixth (1/6) of the gross production of the oil from the leased premises, or one-sixth (1/6) of the value of the gross production thereof; one-sixth (1/6) of the value of the gross production of the gas including casinghead gas or other gaseous substance, produced from said land; where gas from a well producing gas only is not sold or used, Lessee shall pay as royalty Five Hundred Dollars ($500.00) per well per year or the annual rental payment whichever is the greater; one-sixth (1/6) of the value of the gross production of the sulphur from the leased premises, or Two Dollars ($2.00) per long ton, whichever is the greater; one-sixth (1/6) of the value of the gross production of all other minerals from the leased premises, and delayed rental payments of One Dollar ($1.00 per acre per year during the exploratory term of the lease. The highest bidder, in each instance, shall pay on the day of the sale Twenty-five per cent (25%) of the bonus bid and the balance shall be paid within twenty-four (24) hours after being notified the bid or bids has (have) been accepted; payments shall be made by certified check or cashier's check. Lease forms and further particulars may be obtained upon request.

W. H. HOLZMANN, Comptroller
Texas Agricultural and Mechanical
College System

FOR LEASE

5,000-12,700-20,000-40,000 sq. ft. Ideal location for light manufacturing and warehousing of oil equipment. N. Y. C. and B. & O. RR. facilities available. Fourteen trucking lines make LCL pickups daily. Good labor conditions. R. E. Highman, Suttle Equipment Company, Lawrenceville, Ill.

HELP WANTED

DRILLING SUPERINTENDENT

Mid-Continent drilling concern will have opening August 15th for Assistant Drilling Superintendent; age 30 to 35, who has been in supervisory capacity for at least five years as Drilling Superintendent or Tool Pusher. Must have good personality; initiative; and fair educational background. In replying give past five year employment record; state age, marital status and salary expected. All replies handled strictly confidential. Box 89-W, World Oil, Houston, Texas.

Old reliable Eastern manufacturer of oil production equipment desires contact with part time specialty salesman to present our line of Secondary Recovery equipment in all or part of Kansas, Oklahoma, and Texas. Address: Box 90-W, World Oil, Houston, Texas.

HELP WANTED

GEOLOGIST

Rare opportunity with major company. Must have minimum of 7 years experience Mid-Continent area including subsurface, geophysical liaison, and administrative. Age 30-45 Excellent salary and chance for advancement. Address: Box 91-W, World Oil, Houston, Texas.

GEOLOGIST

■ Major company has attractive position for geologist with 6 to 10 years Texas and New Mexico experience. Requires supervision of subsurface work and co-ordination with geophysical data. Age 31-40. Good salary with opportunity for future. Address complete summary of education and experience to Box 92-W, World Oil, Houston, Texas.

WANTED TO BUY

■ We WILL BUY Producing Oil Royalties. Send Particulars. Standard Security Co., 115 Broadway, New York 6, New York.

FOR SALE

■ Well drills, spudders, rotaries, core-drills. All sizes new and used equipment. Tools, drill pipe, cable, pipe. Fishing tools rented. Everything for well drilling. Pressey & Son, Pueblo, Colorado.

■ Completely rebuilt and guaranteed for 60 days, Climax Model R41 gasoline power unit with clutch. 89 net horsepower at 1200 RPM, 72 at 900 RPM continuous. Used less than a year. $1500.00. Wm. F. Surgi Equipment Corporation, P. O. Box 1309, New Orleans, Louisiana.

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For Sale: In Lafayette, La. No. 1814 Houston Highway, lot 100 ft. x 500 ft. with large brick building and large steel building, both with heavy concrete floors. Ideal location and size for oil field machine shop, drilling, material, supply and truck companies. Available now. MIKE DONLON, REALTOR, Lafayette, La.

■ POWER UNITS. 5 K. W., 120 volt, 60 cycles, A. C. single phase. Remote control. Government surplus. New. $1600.00 value, $475.00. Free circular. WELLWORTH TRADING CO., 1831 S. State, Dept. WO, Chicago 16, Illinois.

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New Books, Maps and Movies

Reservoir Engineering

A new book on the complex subject of reservoir engineering contains all the new concepts of the science. Written by Sylvain J. Pirson, special research associate of Stanolind Oil and Gas Company and lecturer in reservoir engineering at the University of Tulsa, "Elements of Oil Reservoir Engineering" is a graduate-level text for petroleum engineers.

The book develops and coordinates the principles which govern the behavior of geological petroleum reservoirs when placed under protection during their primary phase and during the application of external sources of energy as practiced in secondary recovery operations. The discussion develops the concepts of 3 fundamental production processes — water, segregation, and depletion drives, which may operate singly or in combination.

Further treatment is accorded such topics as the application of fundamental equations, the fractional rate of frontal advance formulas, and the material balance equation.

McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 18, $6.50.

Industry and the Public

A new documentary motion picture which depicts the round-the-clock role of oil in the modern world, entitled "24 Hours of Progress," was prepared primarily to help the public reach a better understanding of the men and women of oil and the work they do to assure the social and economic progress of the American people.

Louis de Rochemont, rated one of the foremost documentary film producers in the country, made the picture for OIIC, and Ralph Bellamy, stage, screen and radio actor, is commentator.

"24 Hours of Progress" presents a panorama of oil industry operations and relates them to everyday American life. It shows how oil products help bring a new life into being just as the clock strikes midnight of a typical day. Then, as the hours of the day pass, the camera visits many parts of the country, looking in on homes, farms, factories, stores and communities. The commentary describes the role of oil in connection with each daily scene. The camera also visits an oil derrick, a refinery, a pipe line pumping station and a service station to show oil men at work.

Oil Industry Information Committee, 50 West 50th Street, New York 20, $40.

Our Oil Resources

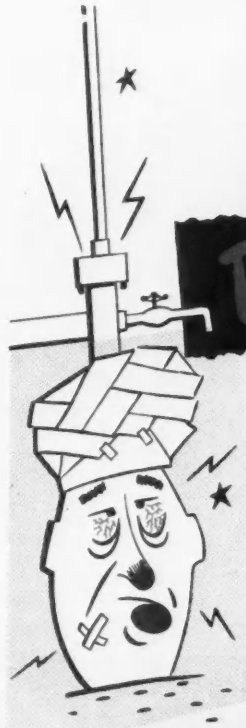
A new book, "Our Oil Resources," edited by Leonard M. Fanning, is a completely revised and up to date edition of a work first published in 1945. Containing timely comments from authorities in the oil industry, the book presents a thorough study of our oil resources not only in terms of geological knowledge but also in terms of human resources.

Important changes made in the technology of exploration and production in recent years are included, as well as considerations such as conservation, the role of technology, oil, natural gas, coal and shale reserves, capital employed in the petroleum and American oil industries, and American oil companies in foreign oil operations.

Containing 406 pages of text and useful photographs and charts, the book is a useful guide to men in the industry as well as those concerned with petroleum as a source of fuel and power in the years ahead.

A few of the well known contributors to the book are Walter S. Hallanan, president, Plymouth Oil Company, and chairman of the National Petroleum Council; Eugene Holman, president, Standard Oil Company (N. J.); L. F. McCollum, president, Continental Oil Company, and chairman of the Subcommittee on Long-Term Availability, API National Oil Policy Committee; and Joseph E. Pogue, former vice president, The Chase National Bank.

McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 18, $5.



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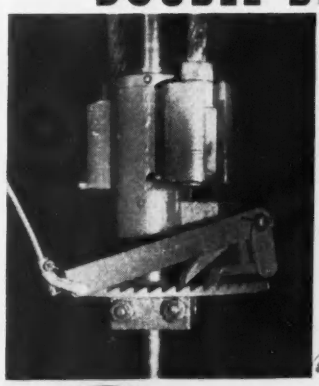
There is no need to put up with this malady . . . no need to give your wells frequent and costly treatments of steaming out or pulling the rods to remove paraffin and maintain production.

Huber Paraffin Scrapers are a permanent cure for paraffin accumulation. Attached to the sucker rods, they wipe the tubing walls clean of paraffin. The scraper blades are shrink-fitted to the rods which are rotated by the Huber Rotating Rod Hanger. Wiping action takes place as the string is rotated and reciprocated.

DOUBLE BENEFIT ROTATION



The combined rotating and reciprocating motion wipes paraffin from the tubing in particles so small they go out in solution . . . can not clog tubing, scrapers, or flow lines. Rod rotation prolongs coupling life by equally distributing wear . . . prolongs pump life and efficiency by equalizing wear on working barrel. Get this added benefit while eliminating paraffin accumulation by installing Huber Scrapers and Huber Rotating Rod Hangers.

Cure your wells of paraffin accumulation . . . install Huber Paraffin Scrapers and Rotating Rod Hanger, NOW!

*Congestion caused by the accumulation of paraffin in pumping wells.

For further information see your local supply store, or write

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PARAFFIN SCRAPERS

SCRAPE AS THEY ROTATE AS THEY RECIPROCATE

Here Is the Pump You've Heard About

Most oil producers have heard of the O'Bannon BABY RED ROD PUMP, but some do not know why it has made such an excellent record for low cost pumping of small wells. Here are some of the reasons:

- **1" Displacement, about 1/3 that of a common working barrel, permits small wells to be pumped at about the same rate as fluid enters well bore. Substitution of a Baby Red for a larger bore pump increases life of rods and pumping unit and often improves production.**
- **Sturdily built, the pump has a strong one-piece metal plunger which is sealed by soft packing positioned around its outside surface. 1¾" balls and seats provide ample fluid passage and minimize tendency to clog and pound out.**
- **Functions as well at 5000 feet as at 500 feet, because seal improves as pressure increases. Many Baby Reds are operating below 5000 feet.**

TYPES: Three types are available: traveling barrel, stationary barrel with top hold-down (illustrated) and stationary barrel with bottom hold-down.

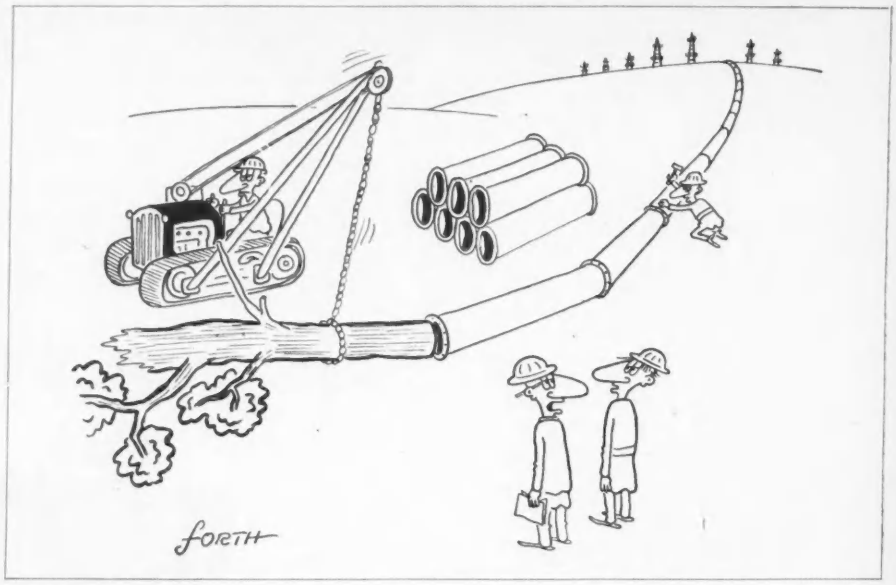
LENGTHS: Made in four lengths for 33", 45", 69" and 93" maximum strokes. Can be used for pumping 1 to 75 barrels per day, depending upon length of stroke and rate.

If you are not already using these pumps in your marginal wells, try one—you'll become another Baby Red fan.

Sold By Supply Stores

Walter O'Bannon Company

Tulsa 1, Oklahoma



"Tell Benson to quit daydreaming and keep his mind on his work!"

A Graft On The Family Tree

One of those benign lady settlement workers stopped a hard-looking youngster and asked where his father was.

"Ain't got no father," said the kid.

"And your mother?"

"Ain't got no mother."

"That's too bad. When did she pass away?"

"I never had no mother."

"Then how were you born?" the lady settlement worker asked in dulcet tones.

"Some bum played a dirty trick on my aunt!"

Accountable

Little Woman: "They have no car, no television set, no piano. I can't imagine what they do have!"

Spouse: "A bank account, perhaps?"

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8. SONIC DEVICE*—Locates collars, liner tops, well bottom, etc.

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5. THIN WALL EXTERNAL CASING CUTTERS*—For outside cutting in small clearances!
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7. ROTARY RELEASING SPEARS—Engages or disengages at will.
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They Call it Progress

When the white man first came to the New World, he found a country peopled by happy, contented Indians who paid no taxes, had no debts, and whose women did all the work. Now the white man is trying to improve on that system.

The Most Private Enterprise

He had been where the oil was in the early days of the East Texas boom, and by a combination of doggedness, hard work and gambler's luck, had become wealthy, independent, and an outspoken champion of private enterprise. Having at last reached an age when he could devote a few months to his own entertainment, he flew to New York, boarded the Queen Mary, and sailed to England. Upon his return, he was asked by a friend his impressions of that country.

"Well, now, I'll tell you about that. I'll just tell you that there's not anyplace at all like the good old U. S. of A., Texas in particular, of course. Now you take, for instance, that King system they got in England. When I first got over there, and learned a little bit about that setup, I thought that, by golly, that's all right. That there King don't do nothing but let people wait on him, and, at my age, that'd sure enough suit me fine. Why, he's got a fellow they call the Chancellor of the Exchequer, and he tells the king how many checks he can write. And there's another one called the Prime Minister, who says all the king's prayers for him. They even got a Minister of Labor, who I guess must be for his wife.

"Well, by the time I'd learned all these things, I was beginning to think that King of England sure must not be very much of a fellow, because he just didn't do anything for himself, but I thought it was all right because, after all, they was foreigners, and maybe you couldn't expect everything to be just like it was back in Texas. But now I'll tell you what finally burned me up, and made me realize just how pitiful that there King is. You know what else he's got? By gosh, if he doesn't have a Privy Counsellor!"

Wage Scale

Proprietor of an optical shop instructing his son on how to charge a customer: "After you have fitted the glasses, say, 'The charge is $10.' Then pause to see if he flinches. If he doesn't flinch, you say, 'For the frames. The lens will be another $10.' Then you pause again, this time only slightly. If he still doesn't flinch you say firmly, 'Each'!"

Crustacean with Crust

A female oyster had just returned from her first date with a lobster and was telling her oyster friends about it.

"He was simply marvelous," she said. "First he looked deep into my eyes. Then he put his arms around me. Then he . . ."

A look of horror came over her as she clutched her throat and cried out: "My Gawd! My pearls!"

What Comes Naturally

"I never heard one man talk so fast in all my life."

"Why shouldn't he? His father was a tobacco auctioneer and his mother was a woman."

All in the Family

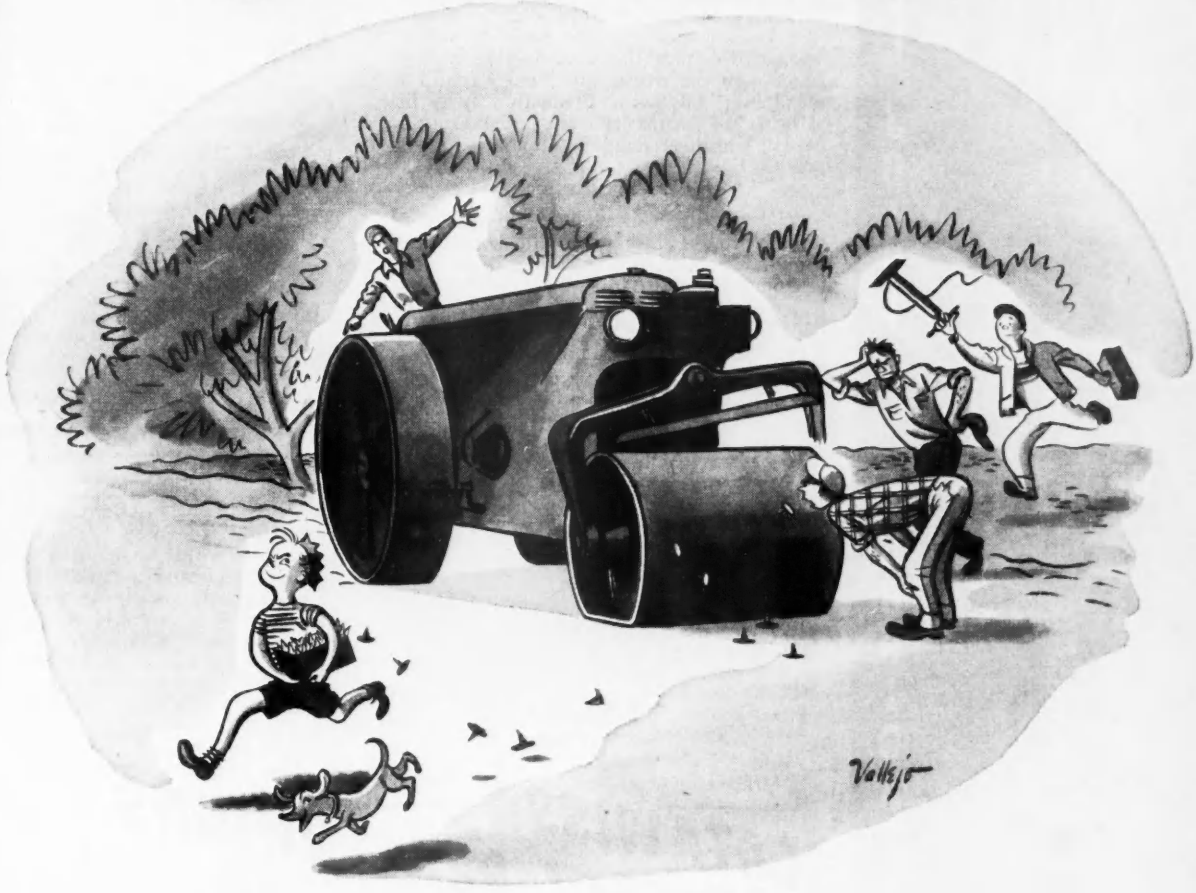
Census Taker (to woman at the door): How many in your family?

Woman: Five. Me, the old man, the kid, the cow and the cat.

Census Taker: And the politics of your family?

Woman: Mixed. I'm a Republican, the old man's a Democrat, the kid's wet, the cow's dry and the cat's a free trader.

Steel Problems?



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THE LESSON HERE is short and to the point. The wrong steel will let you down everytime. The *right* steel will keep you rolling. That's why it pays to call Jorgensen *first* for steel. Jorgensen not only has well-rounded stocks of carbon, alloy, stainless, tool and specialty steels but Jorgensen can supply help in selecting the *one* best steel for your job. Be sharp—for steel or information about steel, *CALL JORGENSEN FIRST!*

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SQUEAKS FROM THE BULLWHEEL

No Guarantee on Parts?

An Indian guide in the Pacific Northwest was given a watch by an appreciative Chicago banker for favors received. One day the watch stopped ticking and the Indian took off the back to see if he could locate the trouble. He poked around in the works and finally found a dead bug. Throwing the watch away in disgust, he grunted, "No wonder him no work, Engineer dead!"

Anti-Hic-Amine

"I know them danged scientists would fool around until they did something they hadn't oughter," stormed the sturdy old man from the hills. "Now look what they've gone and did."

"What's that, Paw," asked the wife, "you mean the atom bomb?"

"Pete's sake, no," exploded the old man. "They've fooled around until they have discovered something besides likker to cure a cold."

Greenleaf Whittler

A waitress is a girl who thinks money grows on trays.

Suspense

A recession is when you need to tighten your belt.

A depression is when you have no belt to tighten.

When you have no pants to hold up, that's a panic.

"All I know is that they joined us somewhere off the Grand Banks."

Same Gang

The little old lady was endeavoring to introduce the new deacon to her equally little old husband — who was somewhat deaf, and a rabid Republican.

"Ezra," she hollered, "this is the new deacon."

"New Dealer?" he barked.

"No, no, Ezra—not New Dealer, new deacon. He's also the son of a bishop."

"Humph!" grunted Ezra. "Every blasted one of 'em is!"

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